

TECHNICAL PUBLICATION 86-3

June 1986

**SOUTH FLORIDA REGIONAL
ROUTING MODEL**

June 1986

SOUTH FLORIDA REGIONAL ROUTING MODEL

TECHNICAL PUBLICATION 86-3
June 1986

SOUTH FLORIDA REGIONAL
ROUTING MODEL

TECHNICAL PUBLICATION 86-3

SOUTH FLORIDA REGIONAL ROUTING MODEL

June 1986

This publication was produced at an annual cost
of \$562 50 or \$1.13 per copy to inform the public.
500 390

by

Paul Trimble

**Water Resources Division
Resource Planning Department
South Florida Water Management District**

LIST OF FIGURES

Number		Page
1	Map of Lake Okeechobee, the Water Conservation Areas and the Interconnecting Canals and Structures	2
2	Block Diagram of the Hydrological Processes Being Modeled	3
3	Illustration of the Applied Methodology to a Single Reservoir for a Single Day	5
4	Illustration of the Applied Methodology to Two Reservoirs Over a Several Day Period	6
5	Stage-Storage Capacity Curve for Lake Okeechobee	8
6a	Stage-Storage Capacity Curves for the Water Conservation Areas	9
6b	Stage-Storage Capacity Curves for the Water Conservation Areas	10
6c	Stage-Storage Capacity Curves for the Water Conservation Areas	11
6d	Stage-Storage Capacity Curves for the Water Conservation Areas	12
6e	Stage-Storage Capacity Curves for the Water Conservation Areas	13
7a	Contours of Bottom Elevations for Lake Okeechobee and the WCA's	14
7b	Contours of Bottom Elevations for Lake Okeechobee and the WCA's	15
7c	Contours of Bottom Elevations for Lake Okeechobee and the WCA's	16
7d	Contours of Bottom Elevations for Lake Okeechobee and the WCA's	17
8	Map of Seepage Coefficients Associated with the Levees Encompassing the Water Conservation Areas	19
9	Historical Flows Returned to the Storage of Lake Okeechobee	20
10	Map of Service Areas	21
11	St. Lucie Basin Runoff Versus Rainfall	22
12	Bar Plot of the Simulated St. Lucie Runoff for a Particular Rainfall Event	24
13	Historical Water Conservation Area Flows that are Returned to their Original Storage Locations	25
14	The Effects of Varying the Local Storage Factor on the Computed Lake Okeechobee Service Area Demands	28
15	The Effects of Varying the Local Storage Factor on the Computed Lake Okeechobee Service Area Demands	29
16	The Effects of Varying the Local Storage Factor on the Computed Lake Okeechobee Service Area Demands	30
17	The Effects of Varying the Local Storage Factor on the Computed Lake Okeechobee Service Area Demands	31

18	The Effects of Varying the Local Storage Factor on the Computed Lake Okeechobee Service Area Demands	32
19	Estimated Annual Demands for Lake Okeechobee	34
20	Diagram of Interflow Between the Groundwater, Canals, and Storage Systems	35
21	Simulated Lower East Coast Groundwater Contours	36
22	Diagram of the Flow Pattern Across a Typical Section of Levee	38
23a	Graphical Representation of the Regulation Schedules	41
23b	Graphical Representation of the Regulation Schedules	42
23c	Graphical Representation of the Regulation Schedules	43
24a	Detail Map of Structures and Canal Locations	44
24b	Detail Map of Structures and Canal Locations	45
25	Discharge Capacity at S-80 versus the Stage in Lake Okeechobee	46
26	Discharge Curve for Gravity Flow from Lake Okeechobee to WCA-3A via the Miami Canal	48
27	Discharge Curve for Gravity Flow from Lake Okeechobee to WCA-2A via North New River Canal	49
28	U.S.G.S. Rating Curve for Hurricane Gates 3, 4, and 5	51
29	Graphical Representation of the Relationship Between Lake Okeechobee Stage and the Value of the Depth Coefficient in the Hurricane Gate Structure Curve	52
30	Rating Curve to Estimate Discharge Capacity from Lake Okeechobee to WCA-1 via the West Palm Beach Canal	54
31	S-39 Discharge Rating Curve	55
32	Maximum Allowable Gate Openings for the S-10 Structures	56
33	Discharge Rating Curve for the S-10 Structures	58
34	Discharge Rating Curve for the S-34 Structures	59
35	Discharge Rating Curve for the S-38 Structures	60
36	Maximum Allowable Gate Openings for the S-11 Structures	61
37	Discharge Rating Curve for S-151	63
38	S-12 Discharges versus WCA-3A Stages	64

39a	Graphical Presentation of Verification	66
39b	Graphical Presentation of Verification	67
39c	Graphical Presentation of Verification	68
40	Present Lake Okeechobee Regulation Schedule and Summary	70
41	An Alternative Lake Okeechobee Regulation Schedule and Summary	71
42	Example of Stage Frequency Curves Generated	72
43	Flow Chart of Computer Model	73

APPENDIX

Number

1	Lake Okeechobee Historical Stages vs. Baserun Stages	77
2	Users Guide	85
3	Fortran Coding	137

ACKNOWLEDGMENTS

The author wishes to thank the many individuals who contributed to the development and documentation of this model. Jorge Marban and Steve Lin deserve special thanks for the valuable suggestions they provided in the conceptual development of the model.

Jim Lane should be recognized for the expertise he provided on the South Florida Water Management Project.

Vince Faraone developed the user friendly package which is documented in the appendix. This package helped tremendously in the organization and documentation of each model run completed.

Special recognition and thanks is to be given to the entire Water Resources technician staff, Dee Azeredo, Karen Lythgoe, Dawn Reid, Barbara Brown, and Rick Miessau, for the excellent job they did collecting and formating data so that it would be accessible to the computer model, for their aid in the development of auxiliary programs to preprocess data, and summarize the model results, and especially for their help in preparing the graphics and diagrams for the final report.

Nettie Winograd should be acknowledged for her effort and patience in typing this report.

I. INTRODUCTION

The hydrologic system of south Florida centers around Lake Okeechobee, the second largest fresh water reservoir lying within the boundaries of the United States. This natural lake is enclosed by a system of levees which were built to further increase the storage capacity of the lake for both flood protection and water supply purposes. Other levees enclose large regions to the south of Lake Okeechobee to provide additional surface water storage for the Lower East Coast service areas. These enclosed regions are the Water Conservation Areas. Inter-connecting these surface water reservoirs to each other, through the agricultural areas, the urban areas, and Everglades National Park, is a complex network of canals. These canals ultimately discharge to the ocean. This hydrological system is illustrated in Figure 1.

Water levels throughout this region are carefully regulated to minimize flood danger during wet periods, while maximizing water supply during dry periods. Changes in management policies and structure capacities are sometimes made due to environmental concerns, agricultural needs, and changing urban water use and flood protection requirements. A thorough investigation of the effects each change will have on regional water levels is required before it is made operational. Consequently, the routing model was developed to aid water managers in the evaluation of the different alternatives. This model projects areal averaged water levels and major structure discharges for Lake Okeechobee and the Water Conservation Areas with different management options and historical climatological conditions imposed. The intention of this report is: 1) to explain the technical detail of the computer model, 2) to describe the required data inputs to the model, and 3) to illustrate the types of model output.

II. METHODOLOGY

The principle objective of the model is to quantify how modifications to the hydrological system will affect the water conditions and discharges for Lake Okeechobee and each Water Conservation Area. Even though a large number of management alternatives must be tested over a long period of historical rainfall conditions, a quick response time is desirable. This is accomplished by 1) using a simple mass balance approach on each reservoir and 2) preprocessing the Lake Okeechobee and Lower East Coast service area water use needs which require more sophisticated models. Constraints on water movement between

basins and surface water reservoirs are incorporated into the model.

A block diagram of the hydrological processes occurring between the Lower East Coast and Lake Okeechobee water systems appears in Figure 2. Each surface water reservoir has a storage capacity determined by the levees that encompass it. The actual amount of storage in each reservoir varies from day to day due to the net flows into or out of it. These flows occur in the form of: 1) overland flow, 2) rainfall (RF), 3) evapotranspiration (ET), 4) seepage, and 5) surface water discharges. The amount of storage change in a particular reservoir for a specific period can be expressed by:

$$\text{DELTA} = \text{RF} - \text{ET} + \text{SFIN} - \text{SFOUT} + \text{SPIN} - \text{SPOUT} \quad (1)$$

where

DELTA- is change in storage,
RF - is rainfall,
ET - is evapotranspiration,
SFIN - is overland flow into a reservoir,
SFOUT- surface water discharges out
of a reservoir,
SPIN - is seepage into a reservoir,
SPOUT- is seepage out of a reservoir.

Daily historical storage change may be modeled by substituting estimated rainfall, ET, seepage and surface flows into Equation 1. Surface flows and rainfall are best estimated from historical measurements while ET and seepage may be estimated as a function of historical pan evaporation and the calculated stage. Calibration of the seepage and ET functions are achieved by adjusting rate coefficients associated with each function until the modeled change in storage best simulates the historical change in storage.

Discrepancies between the simulated results and the actual data may occur for two reasons: 1) inaccurate time varying input data such as rainfall, ET, or overland flow, or 2) oversimplification of the complex physical processes taking place such as seepage, structure discharge, or water use requirements. Furthermore, this procedure requires a large amount of time and effort to obtain reasonable areal estimation of rainfall and other flows which are assumed to remain unchanged under new management schemes.

A simple approach used to minimize these errors and lessen the effort of data collection when running a model is to consider only the components of the water budget that will be altered under new management

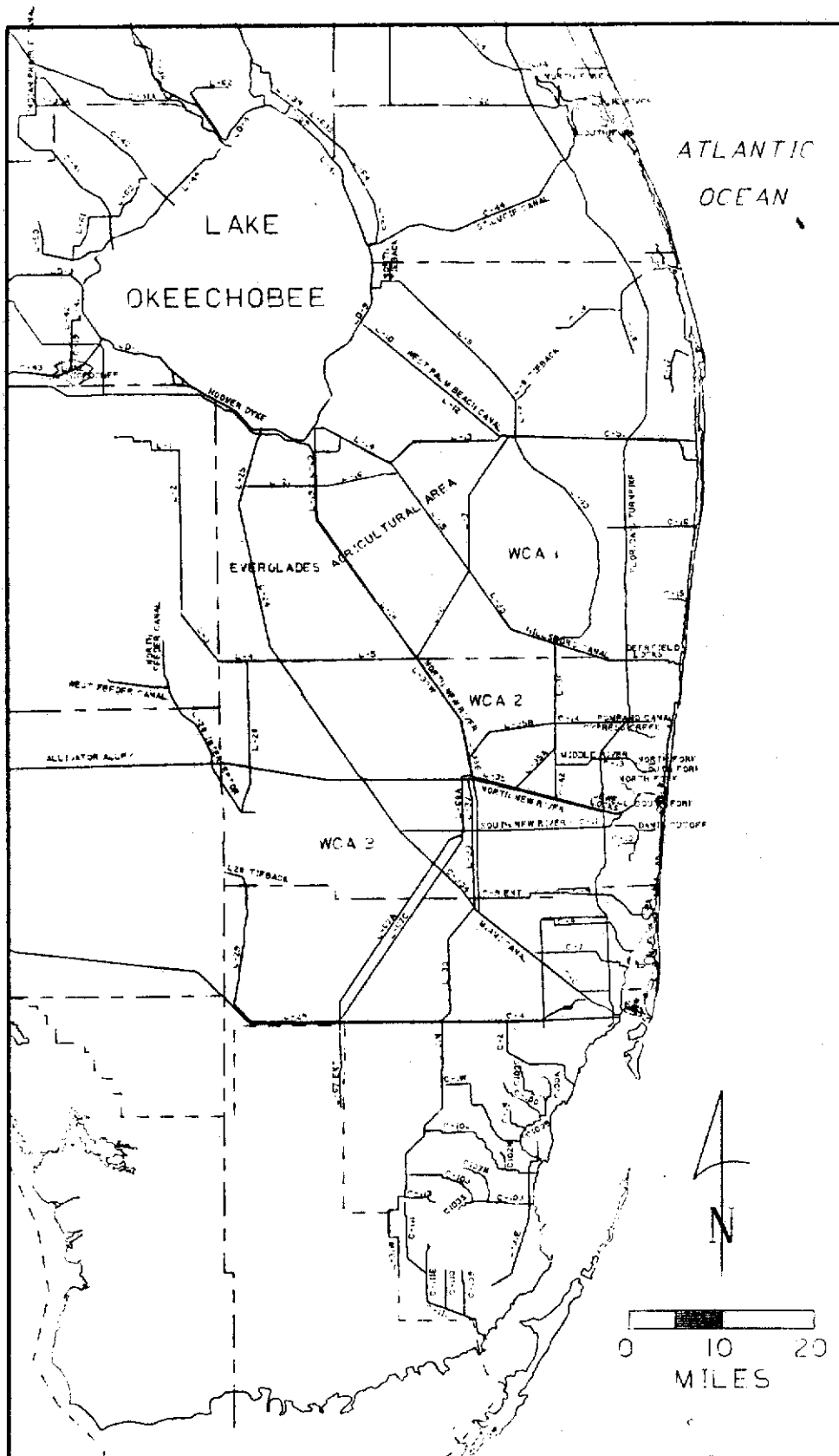
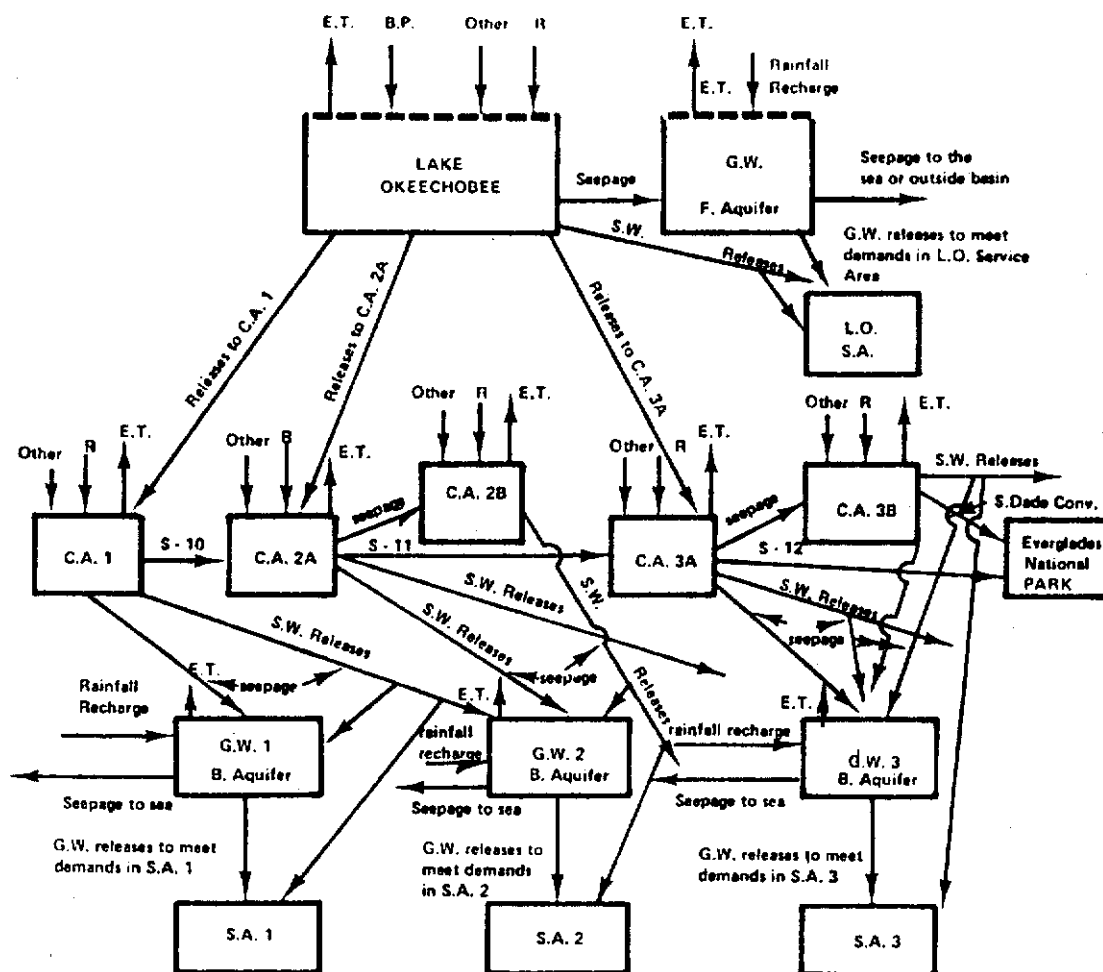


Fig. 1 Map of Lake Okeechobee, the Water Conservation Areas and the Interconnecting Canals and Structures



INDEX

E.T.	=EVAPOTRANSPIRATION
R	=RAINFALL
B.P.	=BACKPUMPING
G.W.	=GROUNDWATER
B.AQUIFER	=BISCAYNE AQUIFER
F.AQUIFER	=FLORIDAN AQUIFER
S.A.	=SERVICE AREA
C.A.	=WATER CONSERVATION AREA
L.O.	=LAKE OKEECHOBEE
S.W.	=SURFACE WATER
L.E.C.	=LOWER EAST COAST

Fig. 2 Block Diagram of the Hydrologic Processes Being Modeled

policies. Certain other components, for example rainfall, are considered to change the storage exactly as they did historically; therefore, the new change in storage may be represented by:

$$\text{NDELTA} = \text{HDELTA} - \text{HISIN} + \text{HISOUT} - \text{NEWOUT} + \text{NEWIN} \quad (2)$$

where

NDELTA - is the new change in storage,
HDELTA - is the historical change in storage,
HISIN - is the historical inflows that will be changed under new management schemes,
HISOUT - is historical outflow that will be altered under new management schemes,
NEWOUT - is the value of the modified outflow,
NEWIN - is the value of the modified inflow.

This equation simply expresses that the difference between the historical flows and the new flows will account for the difference between the historical change in storage and the new change in storage.

This equation is applied in two steps. The first step adjusts the historical change in storage by adding historical outflows that will be altered to it and subtracting historical inflows that will be altered from it. In other words, the reservoir will initially be returned to a pre-management condition for each time step. This adjusted storage change will be referred to as the modified change in storage or modified delta storage interchangeably throughout this report. The second step adds the modified storage change to the initial storage, and calculates the new discharges based on the projected storage quantities, but with new management schemes in effect. See Figure 3 for an illustration of the methodology to a single reservoir and a single time step.

Figure 4 illustrates an application of this method over several days, to two theoretical reservoirs which are interconnected by a canal. A pump system is available to pump water from A to B regardless of the stages in the reservoir. The discharge and storage volumes are measured in units of acre-feet.

Historical storage in each reservoir and discharges between reservoirs are assumed to be known for each day. New values are projected with a new management scheme and historical climatological conditions imposed. Historical flows from reservoir A to reservoir B were always a constant 4 AF; however, management would like to test the effects of delivering water from reservoir A to reservoir B only when storage in reservoir A exceeds that in reservoir B. Maximum flow capacity is assumed to be 4 AF. The effect would

be to decrease the flow volume by 7 AF for the four day period. It is important to note that the modified storage change must be added to the new projected storage from the end of the previous day, and not the historical storage, in order to get the cumulative effects of the proposed management change.

Unfortunately, the picture is complicated when we consider that indirect changes to the system occur when management alters flow patterns. ET is a function of surface area inundated by water, and seepage is a function of stage in the reservoir; therefore, these quantities will also be different due to changes in management schemes. The difference in these quantities must be considered when calculating the change in storage under new conditions. Equation 2 now becomes:

$$\text{NDELTA} = \text{HDELTA} - \text{HISIN} + \text{HISOUT} - \text{NEWOUT} + \text{NEWIN} + \text{HET} - \text{NET} + \text{HSP} - \text{NSP} \quad (3)$$

where

NDELTA, HDELTA, HISIN, HISOUT, NEWOUT, NEWIN are the same as Equation 2,

and

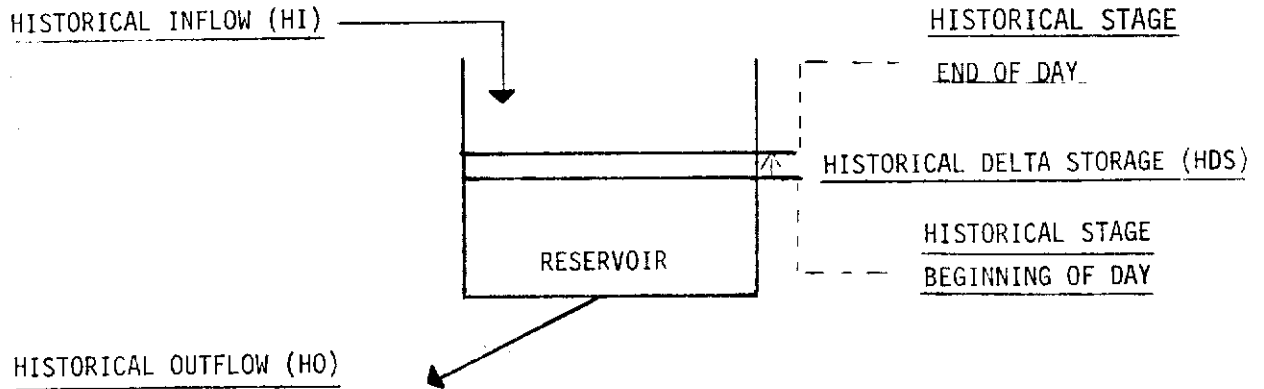
HET - is the historical volume of ET,
NET - is the new volume of ET,
HSP - is the historical volume of seepage,
NSP - is the new volume of seepage.

The errors related to the ET and seepage functions are normally minimized using this methodology since the functions are used only to calculate relative changes in ET and seepage.

The advantages of using this methodology are:

1. It minimizes data collection. For example, estimation of areal rainfall data is not required for each region. Also, other flows that will not change are already accounted for in the historical change in storage.
2. It eliminates estimation of RF and certain other flows, thereby reducing the errors associated with estimating these terms.
3. It minimizes errors associated with functional representations of ET and seepage since estimates of relative changes only are considered.
4. It allows complex regional management options to be analyzed for long periods of record since minimal computer memory is used to model the physical processes. The model's very quick response time is advantageous for management decision-making purposes.

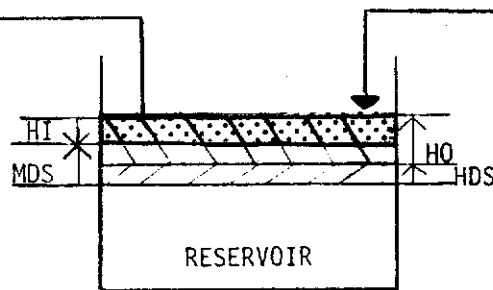
METHODOLOGY APPLIED TO A THEORETICAL RESERVOIR



STEP 1

CALCULATE MODIFIED DELTA STORAGE (MDS)

TAKE OUT
HISTORICAL INFLOW



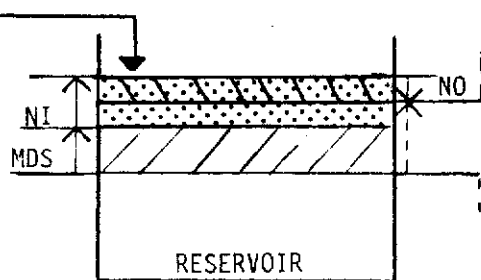
PUT BACK
HISTORICAL OUTFLOW

$$\underline{MDS = HDS + HO - HI}$$

STEP 2

ADD MODIFIED STORAGE CHANGE TO INITIAL STORAGE AND CALCULATE NEW RELEASES

NEW INFLOWS (NI)



PROJECTED FINAL STAGE (PFS)

NEW CHANGE IN STORAGE

INITIAL STAGE (IS)

CALCULATE NEW OUTFLOWS (NO)

$$\underline{PFS = IS + MDS + NI - NO}$$

Fig. 3 Illustration of the Applied Methodology to a Single Reservoir for a Single Day

HISTORICAL STORAGE AND DISCHARGE VALUES		CALCULATE MODIFIED STORAGE CHANGE		ADD MODIFIED STORAGE CHANGE (MDS AND MAKE NEW RELEASES)	
RESERVOIR A	RESERVOIR B	RESERVOIR A	RESERVOIR B	RESERVOIR A	RESERVOIR B
INITIAL CONDITIONS	[30 AF] [30 AF]			[30 AF] [30 AF]	
END OF DAY 1	[32 AF] 4 AF → [25 AF]	32 - 30 - 4 = 6 AF	25 - 30 - 4 = -9 AF	ADD MDS [36 AF] DETERMINE NEW RELEASES [32 AF] 4 AF → [25 AF]	[21 AF] [25 AF]
END OF DAY 2	[26 AF] 4 AF → [34 AF]	26 - 32 + 4 = -2 AF	39 - 34 - 4 = 5 AF	ADD MDS [30 AF] DETERMINE NEW RELEASES [30 AF] NO FLOW	[30 AF] [30 AF]
END OF DAY 3	[25 AF] 4 AF → [39 AF]	24 - 25 + 4 = 3 AF	34 - 39 - 4 = 1 AF	ADD MDS [33 AF] DETERMINE NEW RELEASES [32 AF] 1 AF → [32 AF]	[31 AF] [32 AF]
END OF DAY 4	[24 AF] 4 AF → [34 AF]	24 - 25 + 4 = 3 AF	34 - 39 - 4 = -9 AF	[35 AF] [31 AF] 4 AF → [27 AF]	[23 AF] [27 AF]
TOTAL FLOW	16 AF				9 AF

Fig. 4 ILLUSTRATION OF THE APPLIED METHODOLOGY TO TWO RESERVOIRS OVER A SEVERAL DAY PERIOD

The primary disadvantage of this method is that it is difficult to apply on a fine scale. All water levels are areal averaged levels. A user interested in water distribution within a particular reservoir may need to use a model with finer resolution.

III. MODELING THE PRESENT HYDROLOGICAL SYSTEM (BASE RUN)

Projections are made for the Lower East Coast-Lake Okeechobee hydrologic system to illustrate how water conditions would be different from historical conditions if present day operational policies are incorporated with the historical meteorological conditions that occurred between 1963 to 1983. These projected stages will be referred to as the base run.

Two steps are used when applying this methodology. The first step is the pre-processing of historical data to calculate the Modified Delta Storage and the second step is the calculation of new stages and discharges. These processes are executed separately for computer efficiency and flexibility. In the first step historical daily storage changes are estimated from the daily stage record of each reservoir. The stage-storage curves for Lake Okeechobee and the Water Conservation Areas appear in Figures 5 and 6(a-e). These storage changes are then modified by returning the historical flows that will be altered back to their original location. Historical losses to seepage and ET must also be accounted for as was explained in the previous section. These modified changes in storage may be represented by:

$$MDEL = HDEL + HSP + HET - HISIN + HISOUT \quad (4)$$

where

- MDEL - is the modified change in storage,
- HDEL - is the estimated historical change in storage,
- HSP - is the estimated historical seepage out of the reservoir,
- HET - is the estimated historical ET out of the reservoir,
- HISIN - is the historical inflow that will be modified,
- HISOUT - is the historical outflow that will be modified.

In the second step, the modified change in storages are added to the initial total storage of the appropriate reservoir at the beginning of each time step. ET and seepage values are calculated based on the new water conditions. Then the model will compute discharges based on the new management scheme if they are

required. The water budget under the new management scheme is represented by:

$$NSTOR = STOI + MDEL - NSP - NET - NOUT + NIN \quad (5)$$

where

- NSTOR - is the new storage at the end of the day,
- STOI - is the new storage at the beginning of the day,
- MDEL - is the modified change in storage from step 1,
- NSP - is the new net seepage out of the reservoir,
- NET - is the new ET out of the reservoir,
- NOUT - is the new outflow leaving the reservoir.
- NIN - is the new inflow.

Volume of ET losses are estimated for each reservoir by the equation:

$$VET = DET * SA \quad (6)$$

where

- VET - is the volume of ET (AD),
- DET - is the depth of ET (ft) estimated from historical pan evaporation measurements. (This value is the same for historical and projected conditions),
- SA - is the surface area inundated by water, (acres), and
- * - is the conventional multiplication sign in FORTRAN computer language.

Volume of ET is a function of water levels in the reservoir. As the depth of water increases, the ET processes are allowed to occur over a larger region. Figures 7a through 7d include contours of actual land elevations above sea level for Lake Okeechobee and each of the Water Conservation Areas. Due to the vegetation in the Water Conservation Areas, water may travel very slowly through these regions. This will cause a slope to develop in the surface water elevation and, at the same time, increase the ET surface area. Stage-area curves were derived for the Water Conservation Areas which take into account the sloping pool effect under average conditions. In reality these slopes are not always the same for the same average stage, but are also a function of rainfall distribution and types of discharges entering and leaving the Water Conservation Areas. However, to determine monthly or seasonal values of relative changes in ET, average pool slopes which are a function of stage are used to estimate the surface area inundated.

Volume of seepage losses are estimated by the relationship:

STAGE STORAGE CAPACITY CURVE

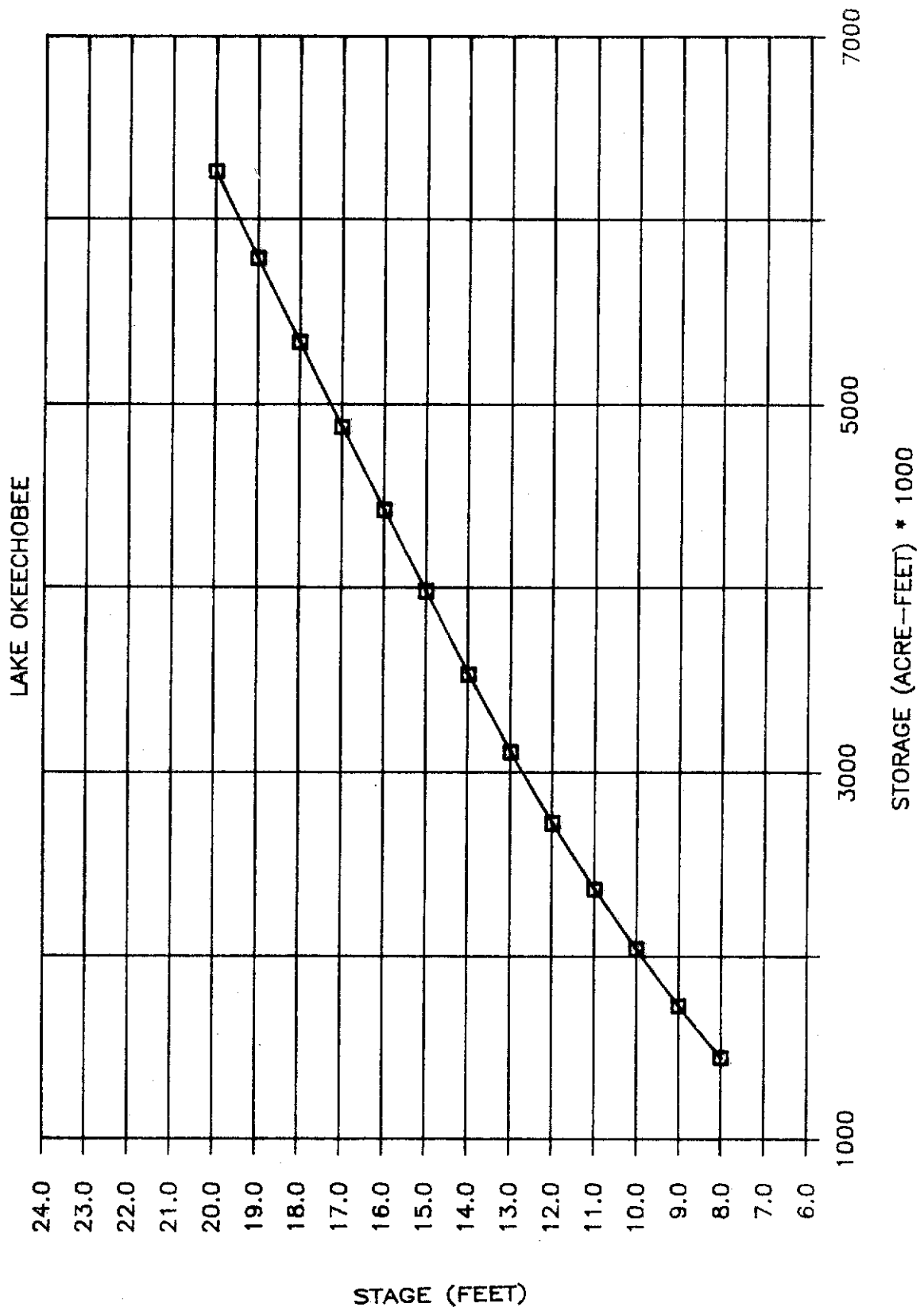


Fig. 5

STAGE STORAGE CAPACITY CURVE

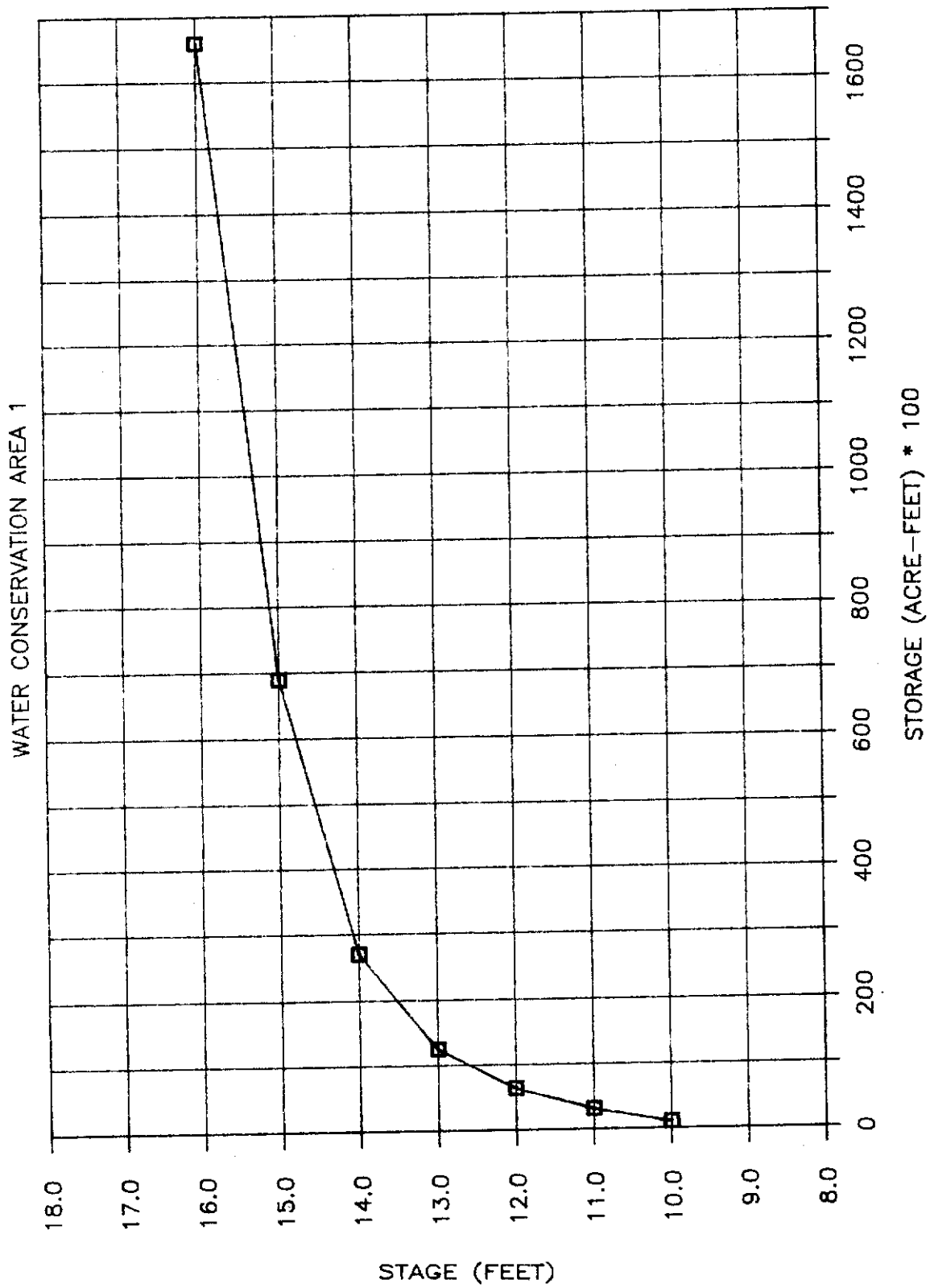


Fig. 6a

STAGE STORAGE CAPACITY CURVE

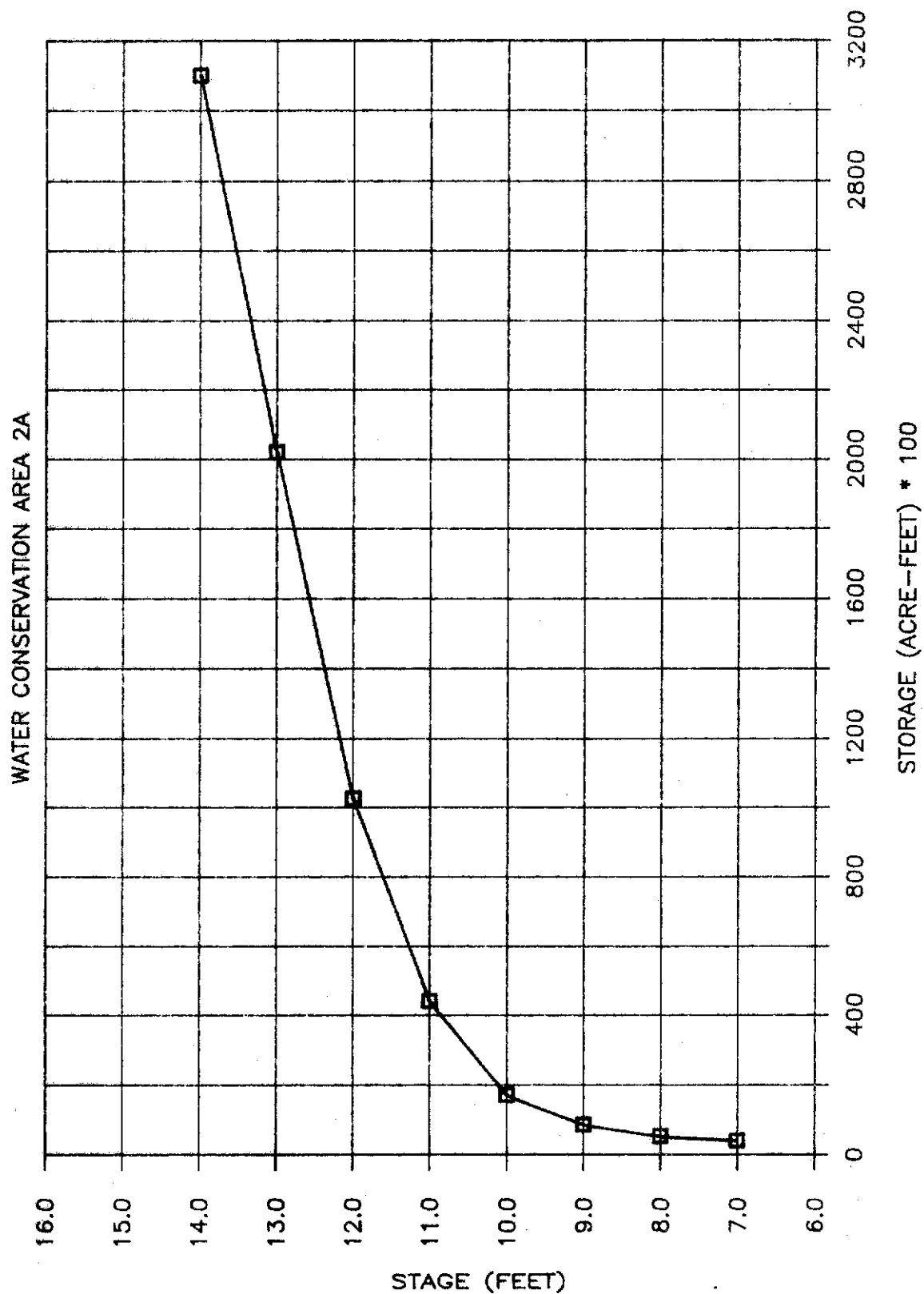


Fig. 6b

STAGE STORAGE CAPACITY CURVE

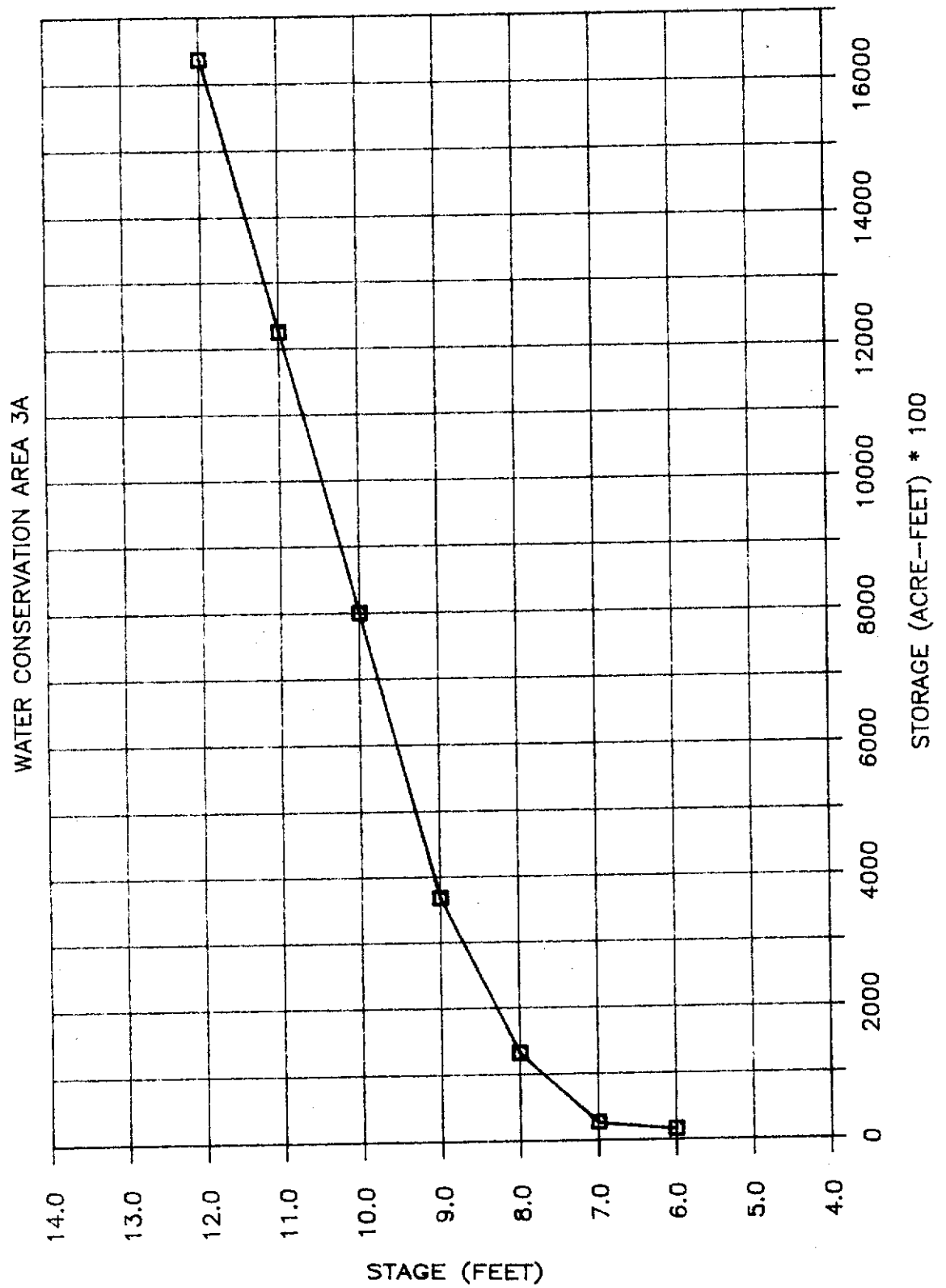


Fig. 6c

STAGE STORAGE CAPACITY CURVE

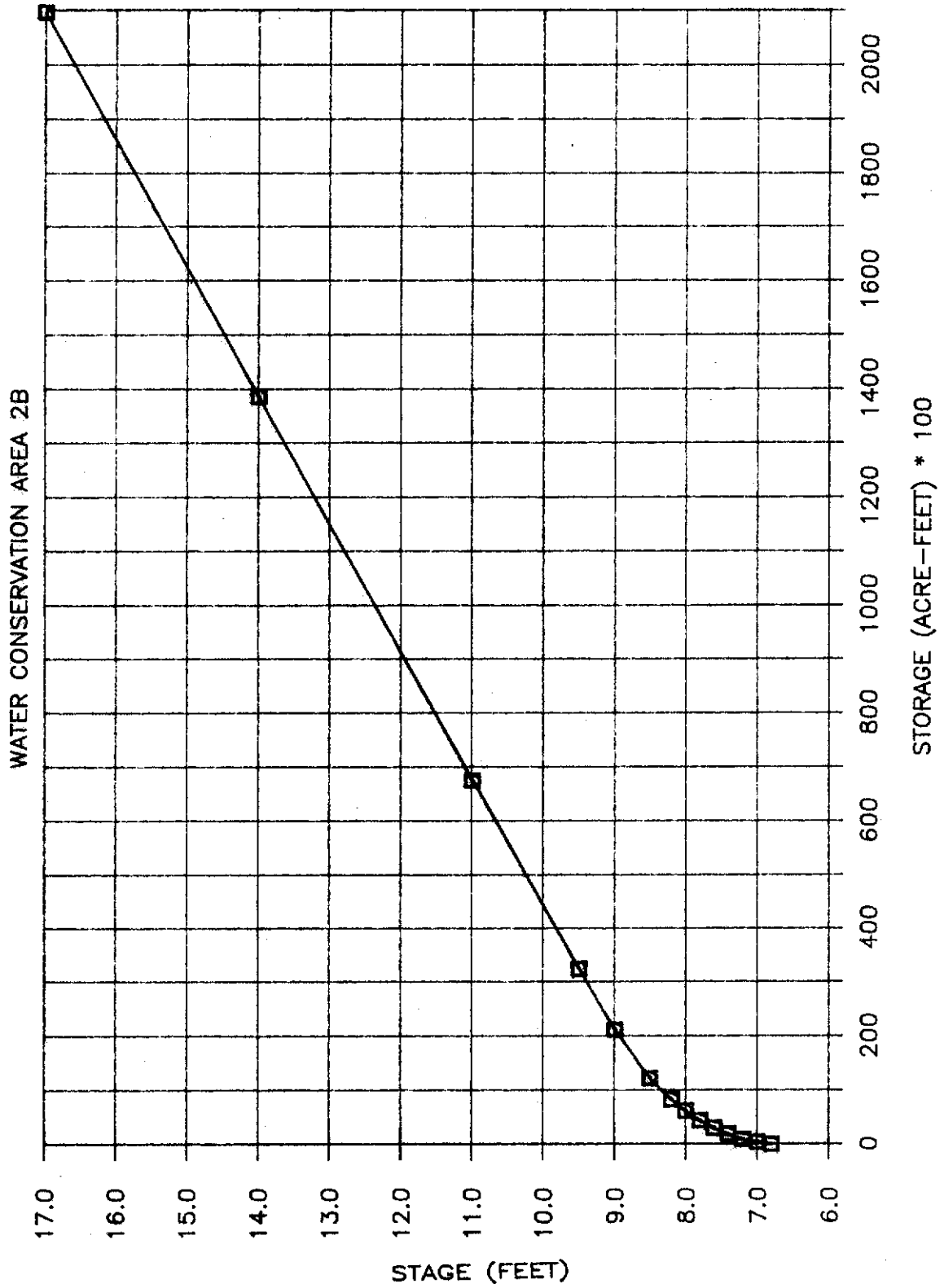


Fig. 6d

STAGE STORAGE CAPACITY CURVE

WATER CONSERVATION AREA 3B

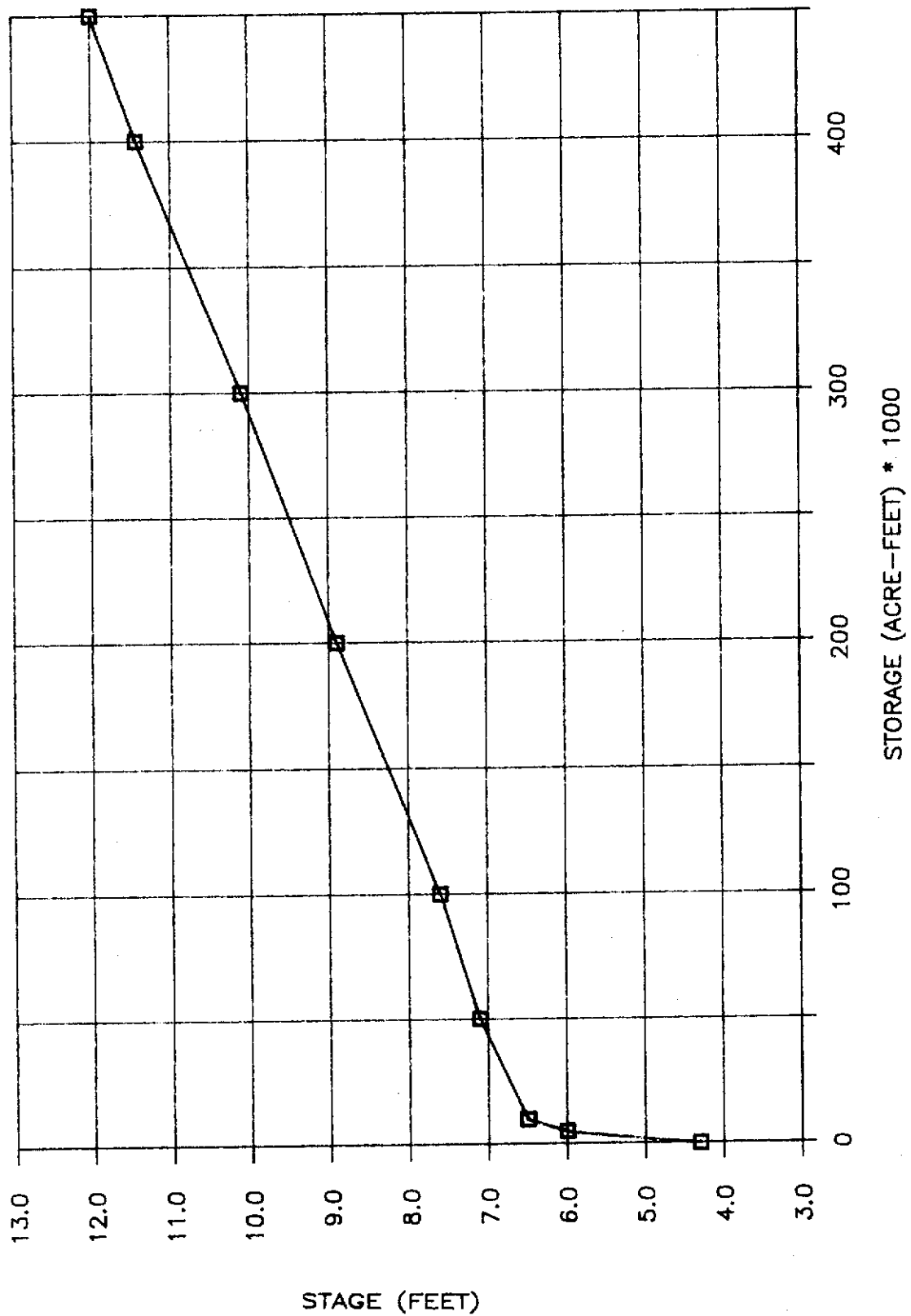


Fig. 6e

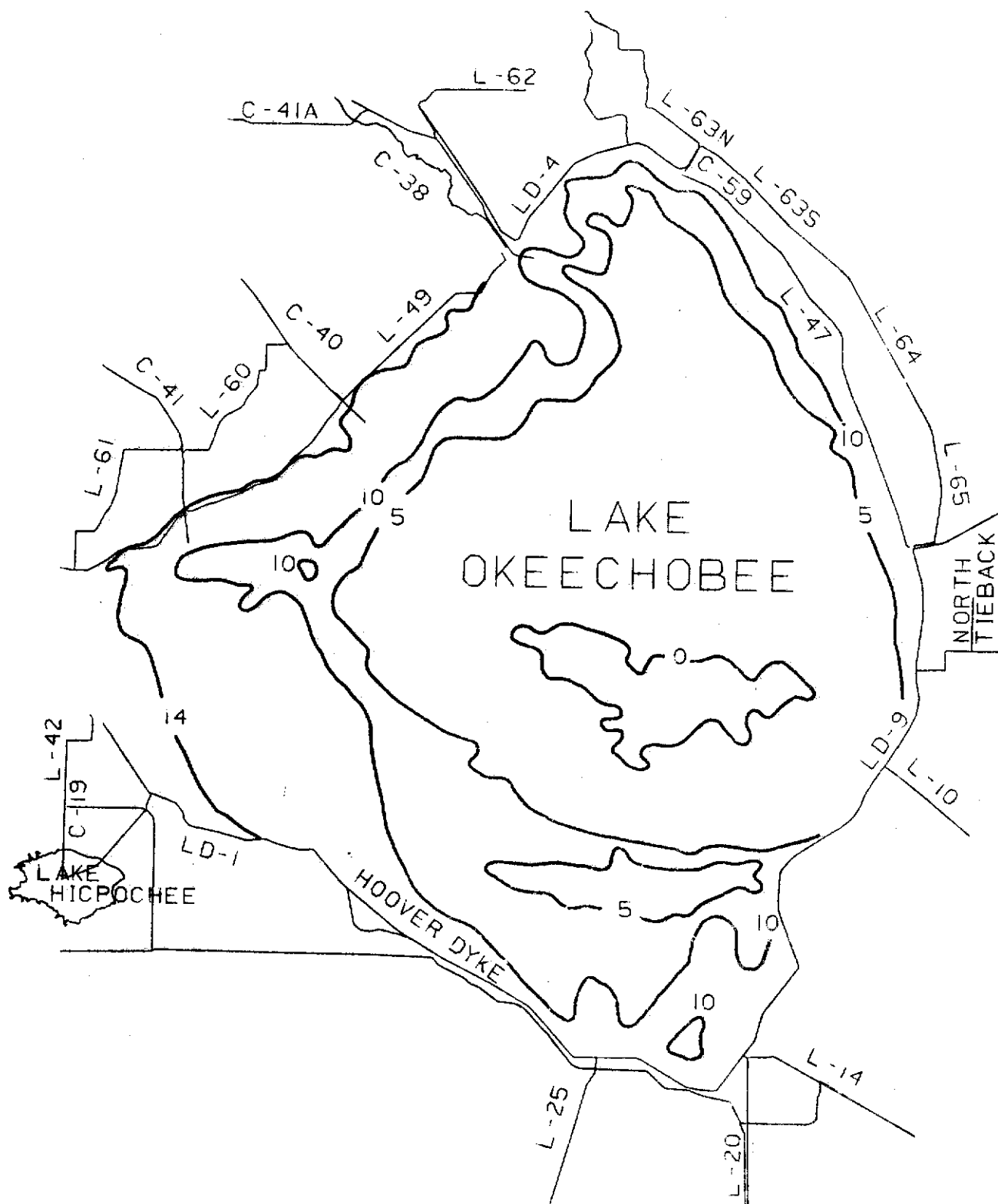


Fig. 7a Contours of Bottom Elevations for Lake Okeechobee

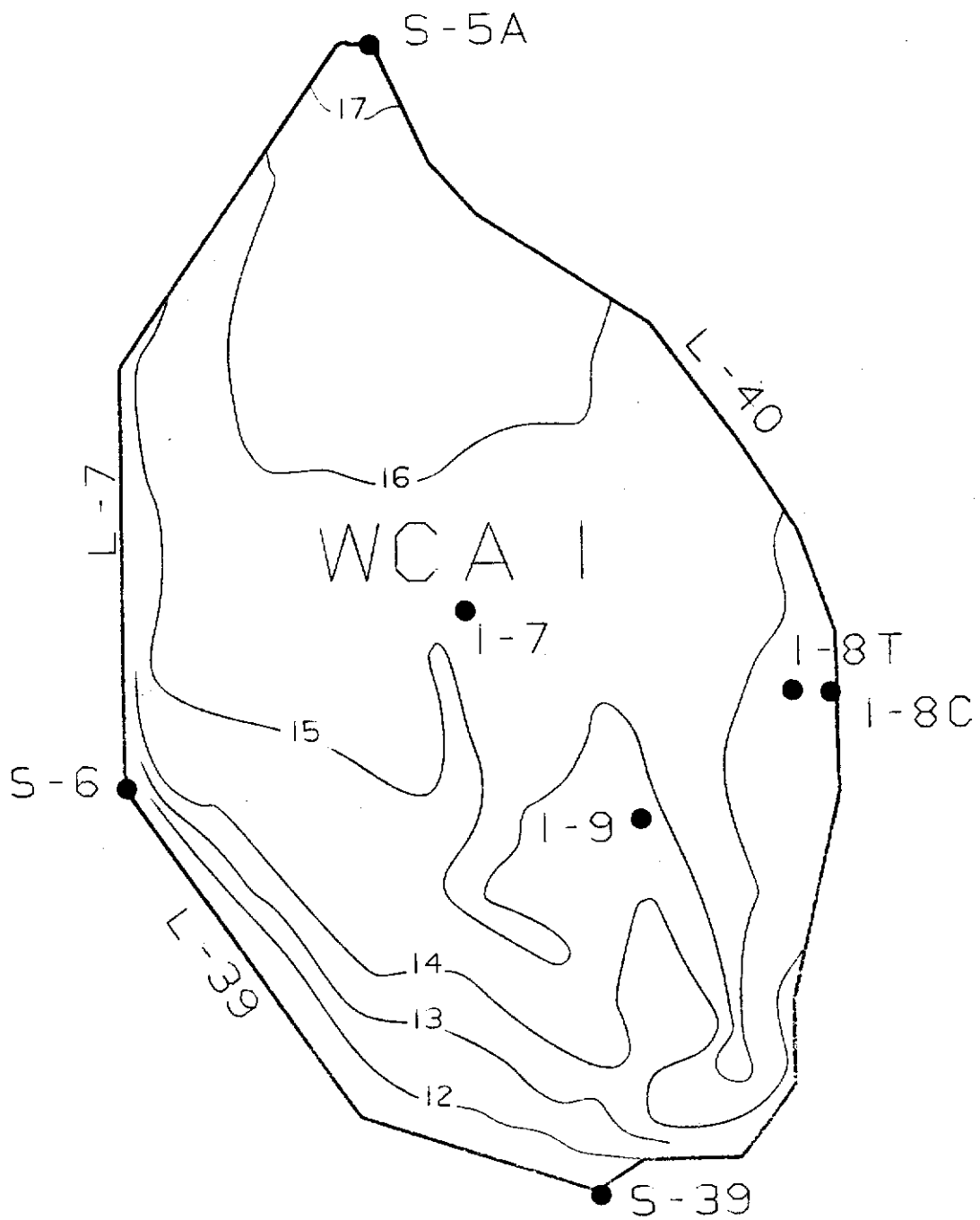


Fig. 7b Contours of Bottom Elevations for Water Conservation Area 1

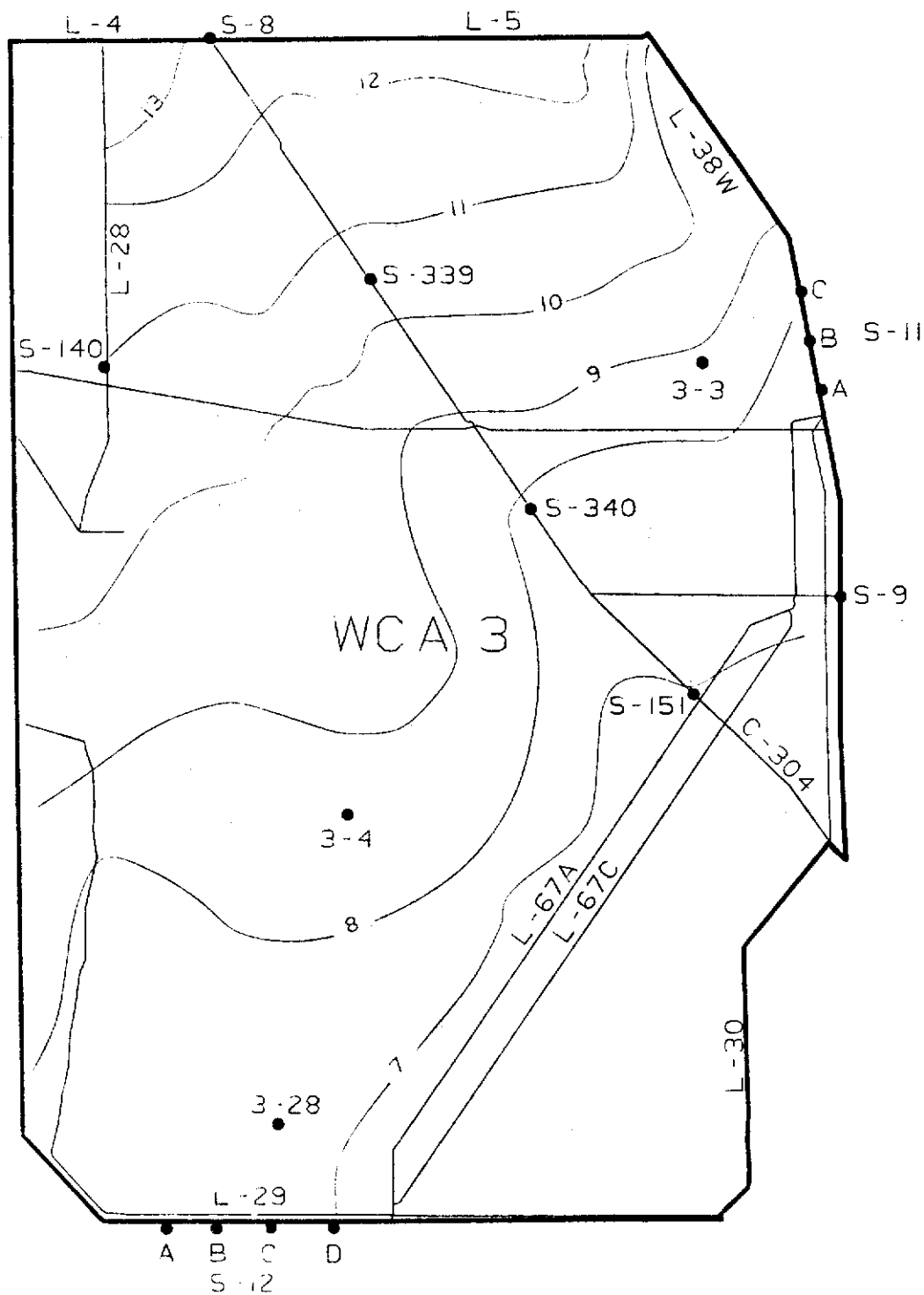


Fig. 7d Contours of Bottom Elevations for Water Conservation Area 3

$$SEEP = HP * LEN * COEFF \quad (7)$$

where

- HP - is the head potential (ft),
- LEN - is the length of the levee (mile),
- COEFF - is the seepage coefficient (cfs/ft/mile). Values for these coefficients appear in Figure 8, and
- * - is the conventional multiplication sign.

The seepage coefficients were determined from pumpage tests completed by the U. S. Geological Survey. Seepage out of Lake Okeechobee and through the northern and western portions of the Water Conservation Areas are minimal due to the very low permeability of the shallow aquifer in this region. These seepages are assumed to be the same volume as they were during the historical periods; therefore, only changes in seepages from the eastern and southern levees of the Water Conservation Areas are considered due to the greater permeability and depth of the aquifer along these levees.

A. Step 1 - Preprocessing Historical Data

1. Lake Okeechobee

Figure 9 illustrates the many different types of releases made from Lake Okeechobee that must be returned to the lake in order that new management schemes may be put into effect and new water releases calculated. One of the major changes in the operation policy of Lake Okeechobee in recent years has been the raising of the lake regulation schedule to increase its storage capability. Historical regulatory releases through the St. Lucie Canal, the Caloosahatchee River, and to the Water Conservation Areas are returned to the lake so that new releases, under alternative schedules, can be computed.

Historical releases made for water use purposes from Lake Okeechobee, either for the Lake Okeechobee service areas or the Lower East Coast service areas, are also returned to the lake so that new daily discharges can be estimated. A map of the service areas appears in Figure 10. All the releases through hurricane gate structures 3, 4, and 5 (HGS3, HGS4, and HGS5), the St. Lucie Canal, and the Caloosahatchee River are returned to the storage of the lake in the preprocessing step. Other releases made directly to the agricultural area through local canals are also added back to the storage of the lake. However, flow measurements through these local outlets are not always available, so historical water supplied to these areas is estimated from the relationship:

$$WU = (PET * K - RF) * A \quad \text{when } PET * K > RF$$

$$WU = 0 \quad \text{when } PET * K \leq RF \quad (8)$$

where

- WU - is water use requirement,
- PET - is the potential evapotranspiration (ft),
- K - is the crop K factor which is a function of crop density, crop type, and season,
- RF - is rainfall (ft), and
- A - is the acreage of a given crop type.

Inflows to the lake from the Kissimmee River, Fisheating Creek, Nubbin Slough, Taylor Creek, and other local inflows are assumed to be the same as they were during the historical model period; therefore, they are accounted for in the historical change in storage. However, inflows from the Everglades Agricultural Area are routed south, when physically possible, under the Interim Action Plan (IAP) and must be removed from the lake storage.

The equation for this modified change in storage is:

$$MDEL = HDEL + S308 + HGS3 + HGS4 + HGS5 + S77 + AG + HET \quad (9)$$

where

- MDEL - is the modified storage change,
- HDEL - is the historical storage change,
- S308 - is the historical S-308 discharges from the lake,
- HGS3 - is the net historical flow through HGS3 and S3,
- HGS4 - is the net historical flow through HGS4 and S2,
- HGS5 - is the historical flow through HGS5,
- S77 - is the historical flow through S-77,
- AG - is the local historical agricultural demand which is met by the lake but is not delivered through one of the major structures, and
- HET - is the historical evapotranspiration losses from Lake Okeechobee.

S-308 has been in operation since July 1977. Before this date S-308 discharges to the St. Lucie Canal were estimated from the S-80 discharges minus the St. Lucie local runoff. These local runoff volumes were determined by a rainfall-runoff curve developed for the St. Lucie basin as illustrated in Figure 11.

Since runoff takes several days to leave the basin, limitations were incorporated into the model to control the amount of flow permitted to leave the basin on a particular day. The remainder of the estimated volume of water was assumed to enter local storage and allowed to leave at a rate of 1300 cfs. An additional limitation put on the runoff distribution

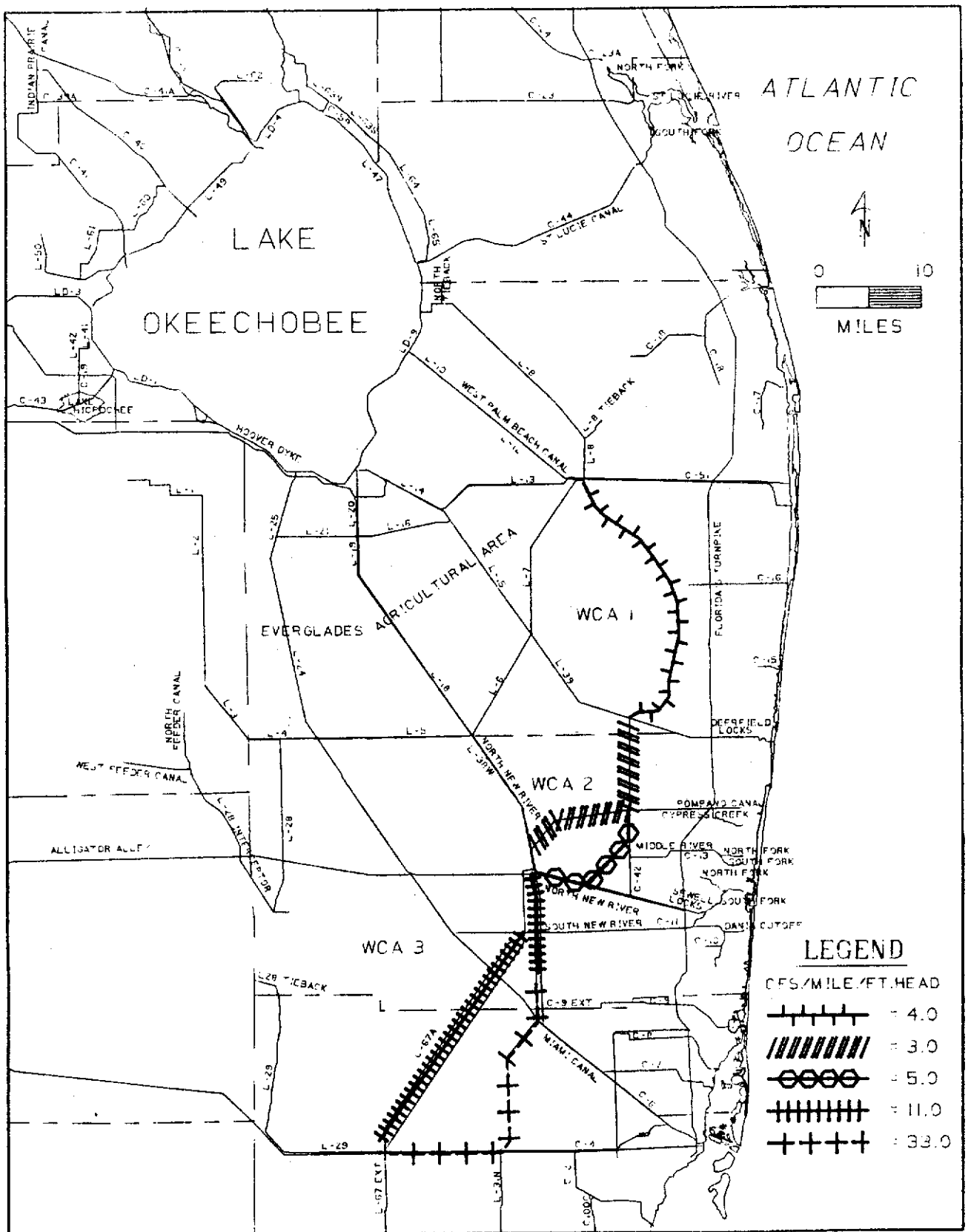


Fig. 8 Map of Seepage Coefficients Associated with the Levees Encompassing the Water Conservation Areas

CALCULATION OF THE MODIFIED DELTA STORAGE FOR LAKE OKEECHOBEE

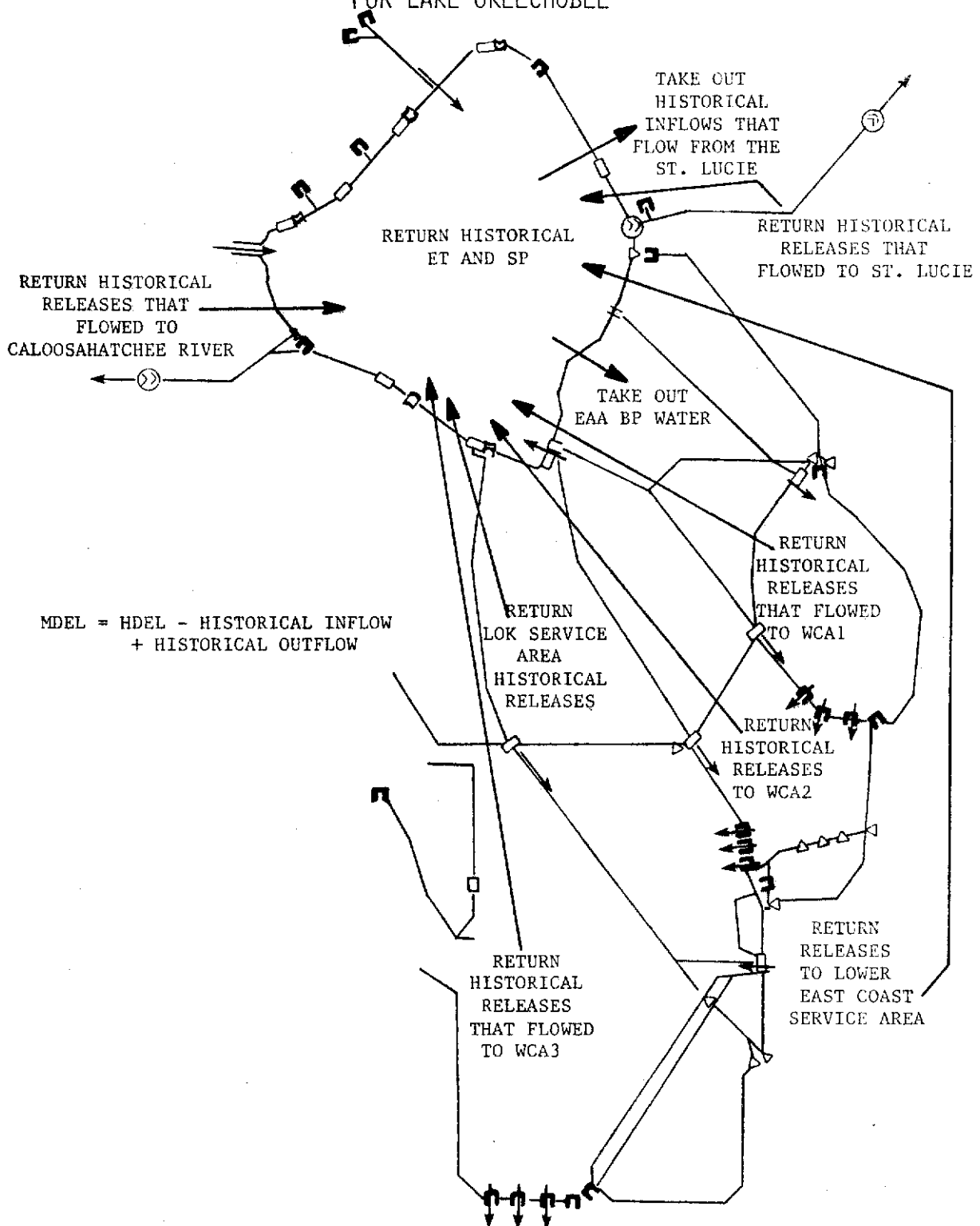


FIG. 9 Historical Flows Returned to the Storage of Lake Okeechobee

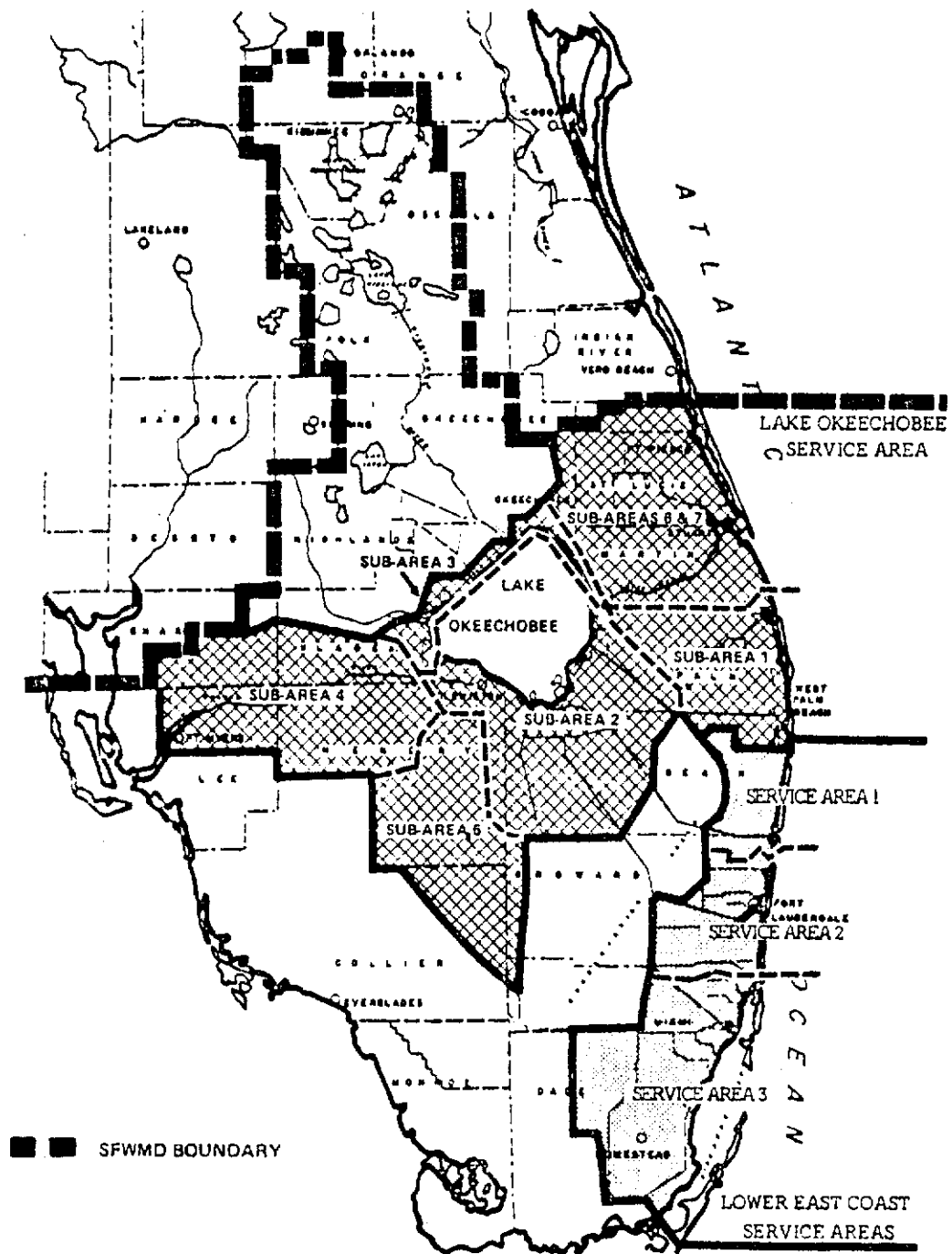


Fig. 10 Map of Service Areas

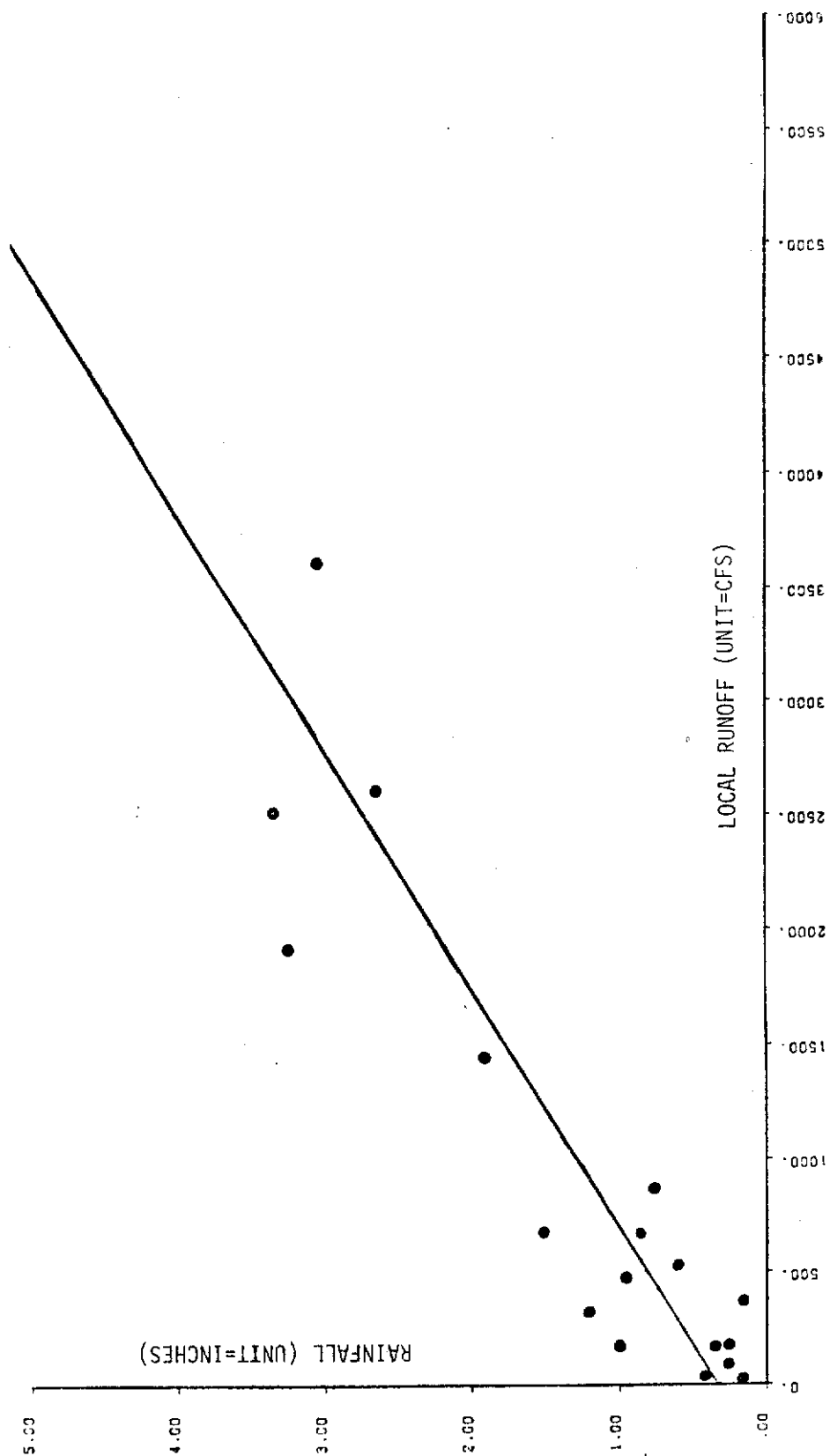


Fig. 11 St. Lucie Basin Runoff versus Rainfall (prepared by S. Lin)

was that only half the runoff remaining in local storage was allowed to leave the basin on a given day. A sample calculation of the St. Lucie basin runoff caused by two days of rainfall in which 2 inches fell each day, is represented in Figure 12. Beyond five days only insignificant runoff leaves the basin.

2. Water Conservation Areas

Major historical flows from Lake Okeechobee are returned to the lake so that deliveries under the new conditions can be simulated. These historical flows to the Water Conservation Areas are sometimes difficult to estimate as the canals interconnecting the lake to the Water Conservation Areas run directly through the Everglades Agricultural Area (see Figure 1). Water that leaves the lake is sometimes consumed in the Everglades Agricultural Area (EAA) and never reaches the Water Conservation Areas. At other times additional runoff from the EAA may cause more water to enter the Water Conservation Areas than leaves the lake. Therefore, in the preprocessing step, all major historical inflows that entered through the S-5A, S-6, S-7, and S-8 structures are removed from the Water Conservation Areas so that new flows through these structures can be calculated with the Interim Action Plan (IAP) in effect. This plan simply routes as much Everglades Agricultural Area runoff water to the Water Conservation Areas as safely possible rather than backpumping it to Lake Okeechobee. Historical flows through the West Palm Beach and Hillsboro Canals in the EAA are accounted for in WCA-1. North New River historical flows are subtracted from WCA-2A storage and the Miami Canal historical flows are subtracted from WCA-3A storage.

Additional historical flows that need to be returned to their original storage locations include water supply and regulatory releases to the east and regulatory releases through S-10, S-11, and S-12. These flows are illustrated in Figure 13.

The equation for the modified change in storage for WCA-1 becomes:

$$MDEL = HDEL + S10 + S39 - S5A - S6 + HSP + HET + S5AS \quad (10)$$

where

- MDEL - is the modified change in storage in WCA-1,
- HDEL - is the historical change in storage,
- S10 - is the historical outflow through the structures,
- S39 - is the historical outflow through the structure,
- S5A - is the estimation of the historical flow

- that traveled into WCA-1 from Lake Okeechobee and the EAA,
- S5AS - is an estimation of historical flow that left WCA-1 through S-5A,
- S6 - is an estimation of the amount of water that traveled from Lake Okeechobee and the EAA to WCA-1 through WCA-1,
- HSP - is historical seepage to the Lower East Coast service areas.
- HET - is an estimation of the value of historical ET.

The equation for the modified storage for WCA-2A becomes:

$$MDEL = HDEL + S11 + S34 + S38 - S7 - S10 + HSP + HET \quad (11)$$

where

- MDEL - is the modified change in storage in WCA-2A,
- HDEL - is the historical change in storage,
- S10 - is the historical flow through the S-10 structures,
- S11 - is the historical flow through the S-11 structures,
- S34 - is the historical flow that flowed to Service Area 2 through the North New River Canal,
- S38 - is the historical flow that flowed through S-38 to Service Area 2,
- S7 - is an estimation of the flow that historically traveled from Lake Okeechobee plus the EAA into WCA-2A through S-7,
- HSP - is historical seepage to the Lower East Coast Service Areas and to WCA-2B,
- HET - is an estimation of the value of historical ET

The equation for the modified change in storage for WCA 3A becomes:

$$MDEL = HDEL + S12 + S151 - S8 - S11 - S150 + S333 + S343A + S343B + HSP + HET \quad (12)$$

where

- MDEL - is the modified change in storage in WCA-3A,
- HDEL - is the historical change in storage,
- S12 - is the historical flow through the S-12 structures from WCA-3A to Everglades National Park,
- S343A - is the historical flow through S-343A,
- S343B - is the historical flow through S-343B,
- S333 - is the historical flow through S-333,
- S151 - is the historical flow through S-151 to WCA-3B,

Simulated St. Lucie Runoff

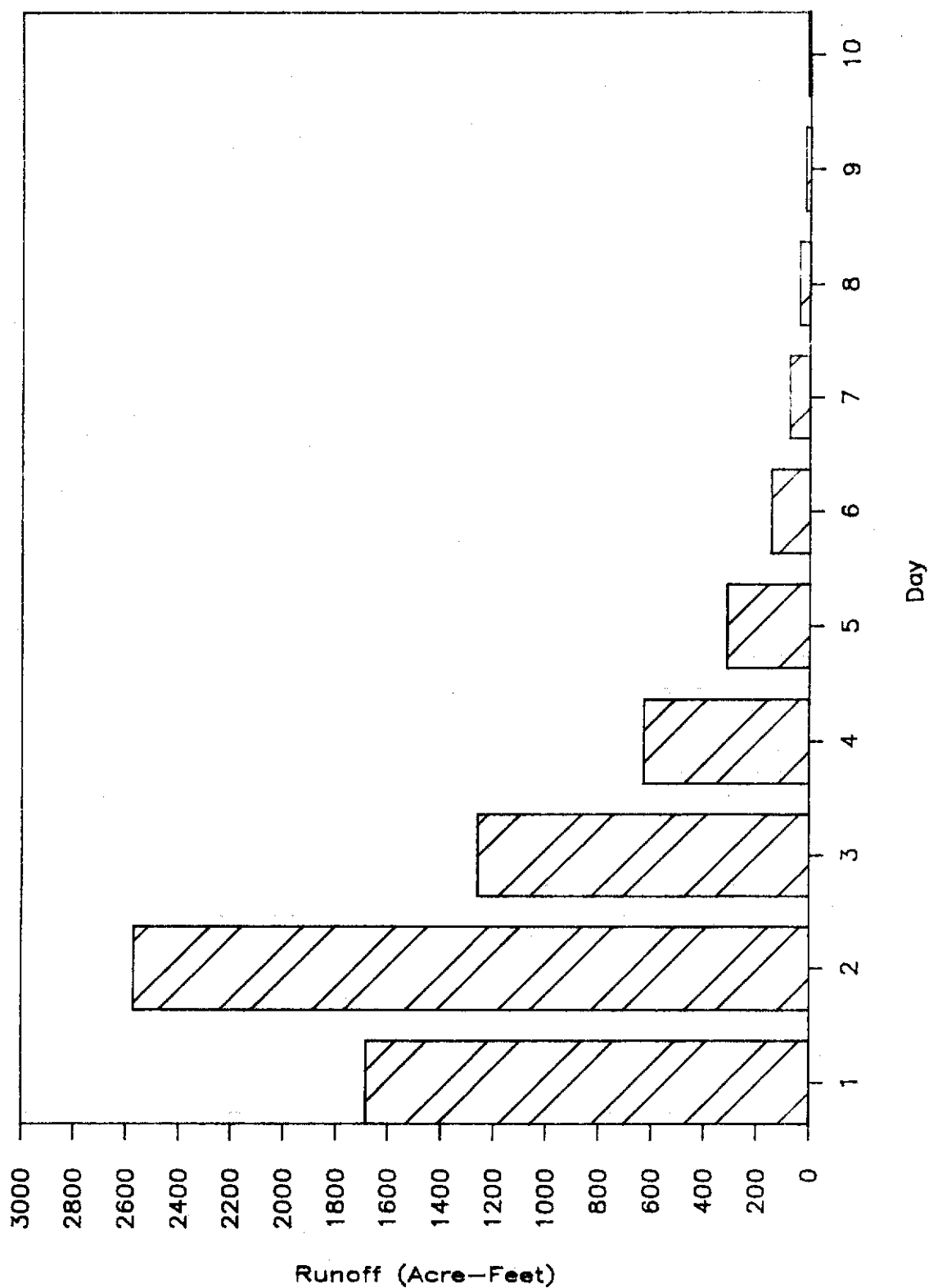


Fig. 12 Bar Plot of the Simulated St. Lucie Runoff for a Particular Event

CALCULATION OF THE MODIFIED DELTA STORAGE FOR WATER CONSERVATION AREAS

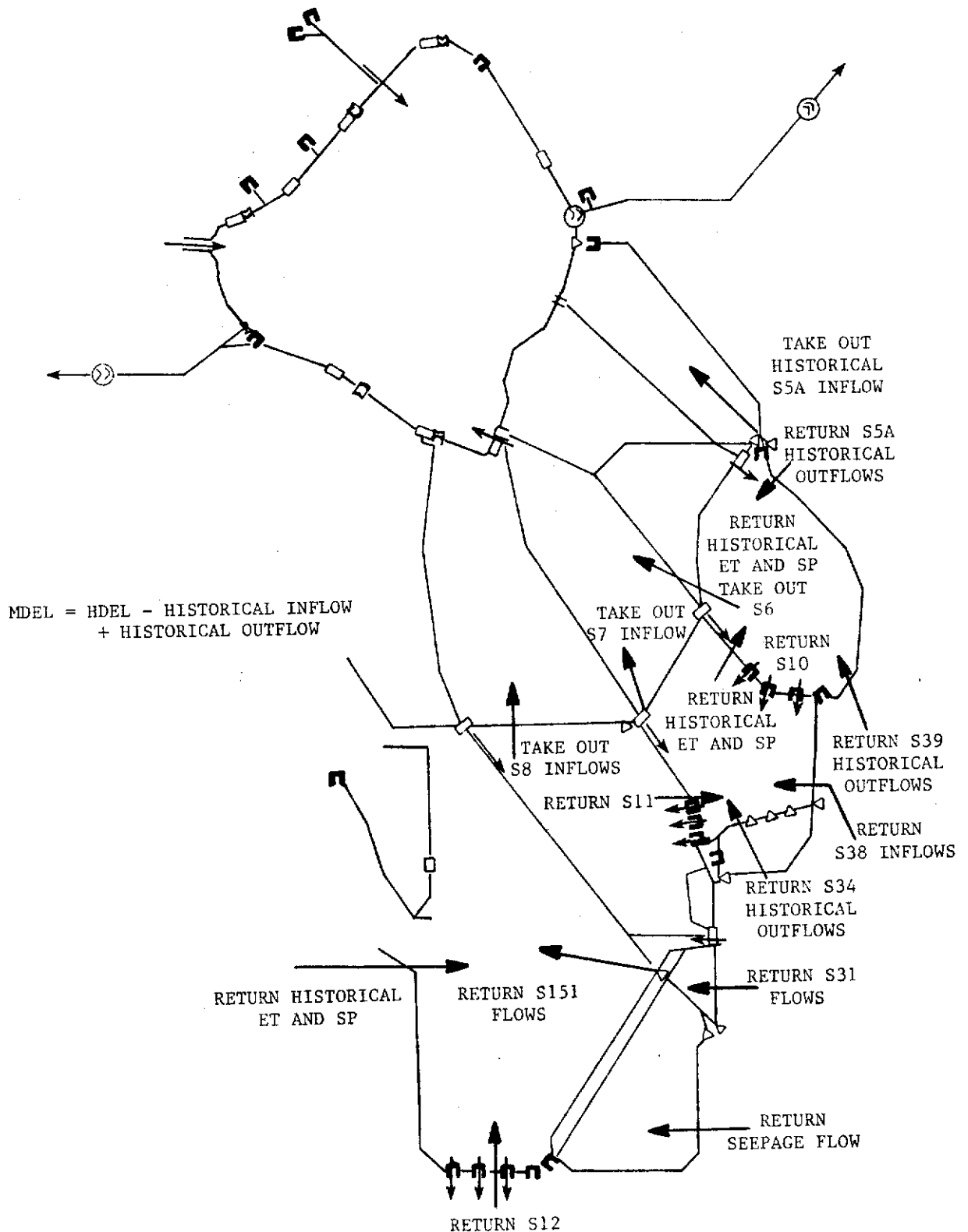


Fig. 13 Historical Water Conservation Area Flows that are Returned to their Original Storage Locations

- S11 - is the historical flow from WCA-2A to WCA-3A,
 S8 - is an estimation of flow that traveled from Lake Okeechobee plus EAA into WCA-3A through the Miami Canal,
 HSP - is historical seepage to the Lower East Coast service areas and WCA-3B,
 HET - is historical ET out of the Water Conservation Area.

The equation for the modified change in storage for WCA-2B is:

$$MDEL = HDEL - SEEPI + SEEPO \quad (13)$$

where

- MDEL - is the modified change in storage for WCA-2B,
 HDEL - is the historical change in storage for WCA-2B,
 SEEPI - is the historical seepage into WCA-2B from WCA-2A,
 SEEPO - is the historical seepage to the coastal regions from WCA-2B.

and likewise the equation for the modified change in storage for WCA-3B is:

$$MDEL = HDEL + SEEPO - SEEPI \quad (14)$$

where

- MDEL - is the modified change in storage for WCA-3B,
 HDEL - is the historical change in storage for WCA-3B,
 SEEPI - is the historical seepage into WCA-3B from WCA-3A,
 SEEPO - is the historical seepage from WCA-3B to the coastal regions.

Other structure flows that existed but are not implicitly referenced as flows entering or leaving the Water Conservation Areas in Equations 10-14 are assumed to affect the hydrological system just as they did historically.

Step 1 is completed after each of these modified storage changes are calculated.

B. Step 2 - Calculation of New Water Levels

Initially, the modified storage changes are added to the total storage contained in each reservoir. This is represented by the following expression:

$$STO = ISTO + MDEL \quad (15)$$

where

- STO - is storage after the modified storage is added, but before new releases are made,

ISTO - is the initial storage,
 and

MDEL - is the modified change in storage.

Next, runoff from EAA is estimated from historical discharges. With the Interim Action Plan which is presently in effect, this water is added to the WCAs if it is less than the system conveyance limitations to the WCAs; however, during heavy rainfall events some water may still need to be backpumped to Lake Okeechobee for flood protection. A regression analysis was completed for the period since the IAP went into effect in 1979 to determine the relationship of necessary backpumping to the lake versus the total runoff; however, due to the scatter in the data these relationships should be used with caution. A more sophisticated model, along with finer resolution rainfall data, is needed to obtain reasonable daily backpumping values. For monthly or seasonal results, these relationships work reasonably well. The equation for the Everglades Agricultural Area via the Miami Canal is:

$$BP = .45*(RO) - 1047 \quad (16a)$$

where

- BP - is the estimated backpumping (Af) to Lake Okeechobee from the Miami basin.
 RO - is the total historical runoff (Af) from the Miami Canal basin between S-8 and HGS3.

When BP is less than zero, then no runoff will enter Lake Okeechobee from the Miami Canal. Total runoff is determined from the historical net flow out of a basin on a particular day. Therefore, runoff equals:

$$RO = S8 - HGS3 \quad (17)$$

where

- RO - is runoff (Af),
 HGS3 - is total volume of water entering the Miami Canal through the S-3 and HGS3 structures (Af). (Negative values indicate flows to the lake.)

A similar regression analysis for the Hillsboro-North New River Canal system gives the following relationship for daily backpumping to Lake Okeechobee.

$$BP = .45*(RO) - 1360.68 \quad (18a)$$

where

- BP - is the estimated backpumping (Af) for the Hillsboro-North New River Canal,
 RO - is the total runoff from the basin (Af).

Total runoff from this basin is determined by the relationship:

$$RO = S7 + S150 + S6 - HGS4 \quad (19)$$

where

- S7 - is flow through S-7 (Af),
- S150 - is flow through S-150 (Af),
- S6 - is flow through S-6 (Af),
- HGS4 - is flow through the HGS4 and S-2 structures (Af).

The portion of the runoff that is not backpumped to Lake Okeechobee from the Hillsboro Canal and North New River Canal is routed to WCA-1 and WCA-2A respectively.

The total West Palm Beach Canal basin runoff is assumed to enter into WCA-1. Usually this is necessary since there is no pump located at the north end of the canal and gravity flow back to the lake usually does not exist. After the runoff from the Everglades Agricultural Area is routed to storage, new discharges plus water levels are calculated.

An option has been incorporated into the model to operate the structures and pumps surrounding the EAA as they were prior to the IAP being put into action. This was completed to study the effects the IAP has on water supply, and to consider the feasibility of treating the runoff so it may be backpumped into the lake for water supply purposes.

The relationships developed for the backpumping option were determined by a regression analysis of runoff versus backpumping data for the period prior to 1979 for the Miami, North New River, and Hillsboro Canals. The relationships for determining the daily backpumping from the Miami Canal prior to the IAP is:

$$BP = .416*(RO) - 14.3 \quad (16b)$$

and for the Hillsboro-North New River system:

$$BP = .431*(RO) - 5.06 \quad (18b)$$

where RO and BP in Equations 16b and 18b are defined as their counterparts in 16a and 18a respectively.

IV. SURFACE WATER DISCHARGES

Surface water discharges are made from reservoirs for two purposes: 1) for water use, and 2) flood control. The quantity of discharge from one region to another is limited by the capacities of the structures and canals that interconnect these regions. These limitations are incorporated into the model in the form of stage-discharge curves which will be discussed in detail in sub-section C.

A. Water Supply

1. Lake Okeechobee Service Areas

a. Definition. Water supply requirements are preprocessed for each of the Lower East Coast and Lake Okeechobee service areas. Lake Okeechobee agricultural demand includes water use requirements for the plants and for seasonal flooding of the land for certain crops which must be supplied from Lake Okeechobee. Rainfall and local storage are the alternate sources for meeting these requirements; therefore, agricultural demand can be defined mathematically by:

$$AD = (PET * K + FD - RF) * SA - LSA \quad (20)$$

where

- AD - is agricultural demand (Af),
- PET - is potential evapotranspiration (ft),
- K - is the crop K factor which is a function of crop density and type,
- FD - is average flooding depth (ft),
- RF - is rainfall (ft),
- SA - is cultivated area (acres),
and
- LSA - is the sum of local storage available in Lake Okeechobee's service areas (Af).

This demand is calculated on a daily basis with a running count of LSA determined as a function of rainfall and ET. Water use requirements are defined to be zero if the sum of the terms in the Equation 20 are less than zero. Added to this agricultural demand is the municipal demand of the region surrounding Lake Okeechobee which obtains its water directly from the lake. A maximum value of local storage available is estimated through a calibration process which compares total non-regulatory outflow from Lake Okeechobee to that estimated by Equation 20.

b. Analysis of Computed Water Use Requirements. Figures 14-18 illustrate the effect of changing the local storage factor. During the period of 1981 and early 1982, Lake Okeechobee was at very low levels; therefore, all of the demands were not met and estimated water needs were higher than the actual releases. During this period local service area storage was also depleted by the drought. When the rains occurred in the late spring and early summer of 1982, water was not only supplied for plant needs, but also to replenish the overdrawn local storage; therefore, estimated demands should be small when compared to actual water deliveries. With these facts in mind, a maximum local storage factor of 250,000 AF was chosen as the most reasonable value. It should be noted that local storage was depleted in April and May 1981 so that calculated demand did not change in all

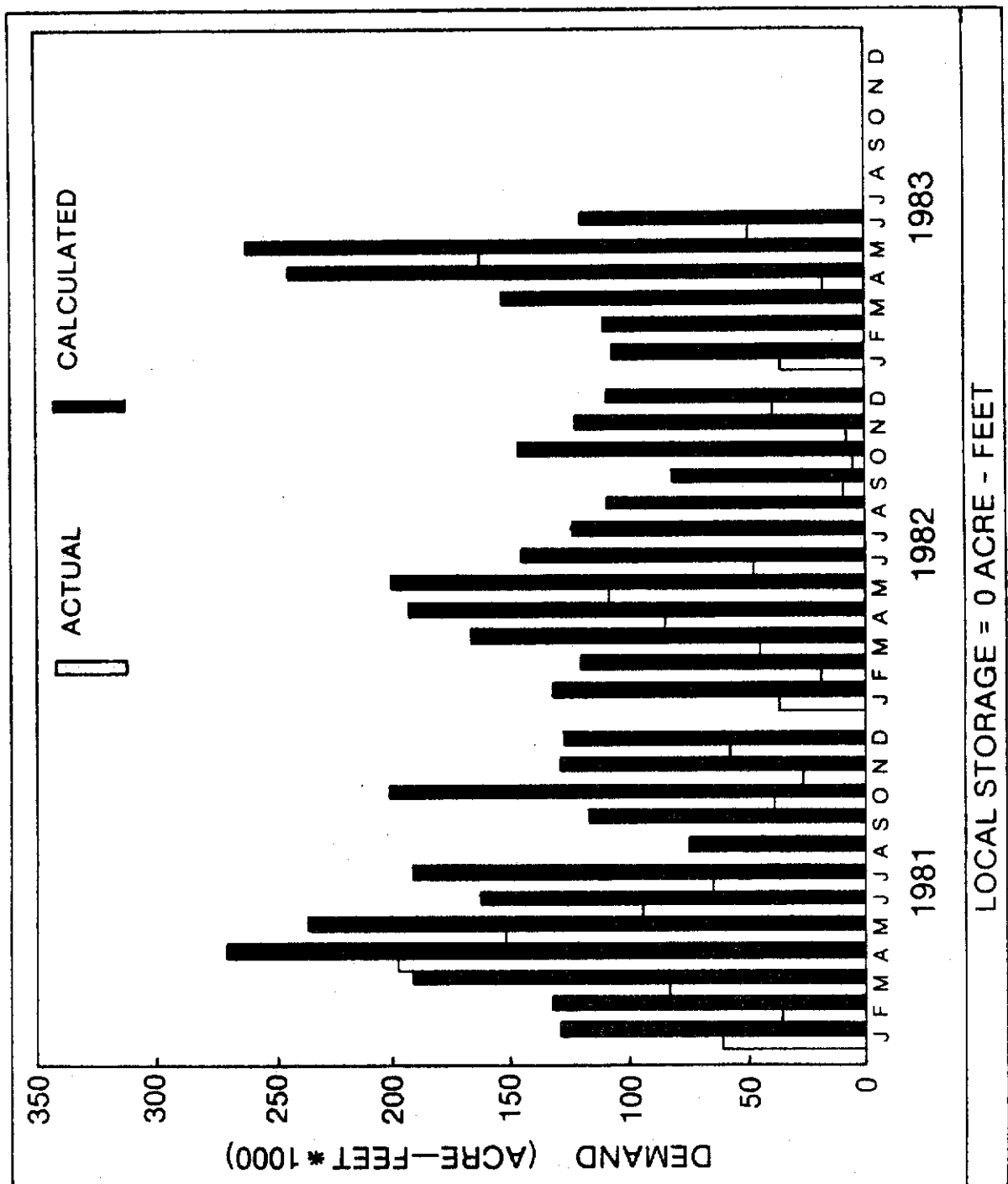


Fig. 14 The Effect of the Local Storage Factors on the Computed Lake Okeechobee Service Area Demands

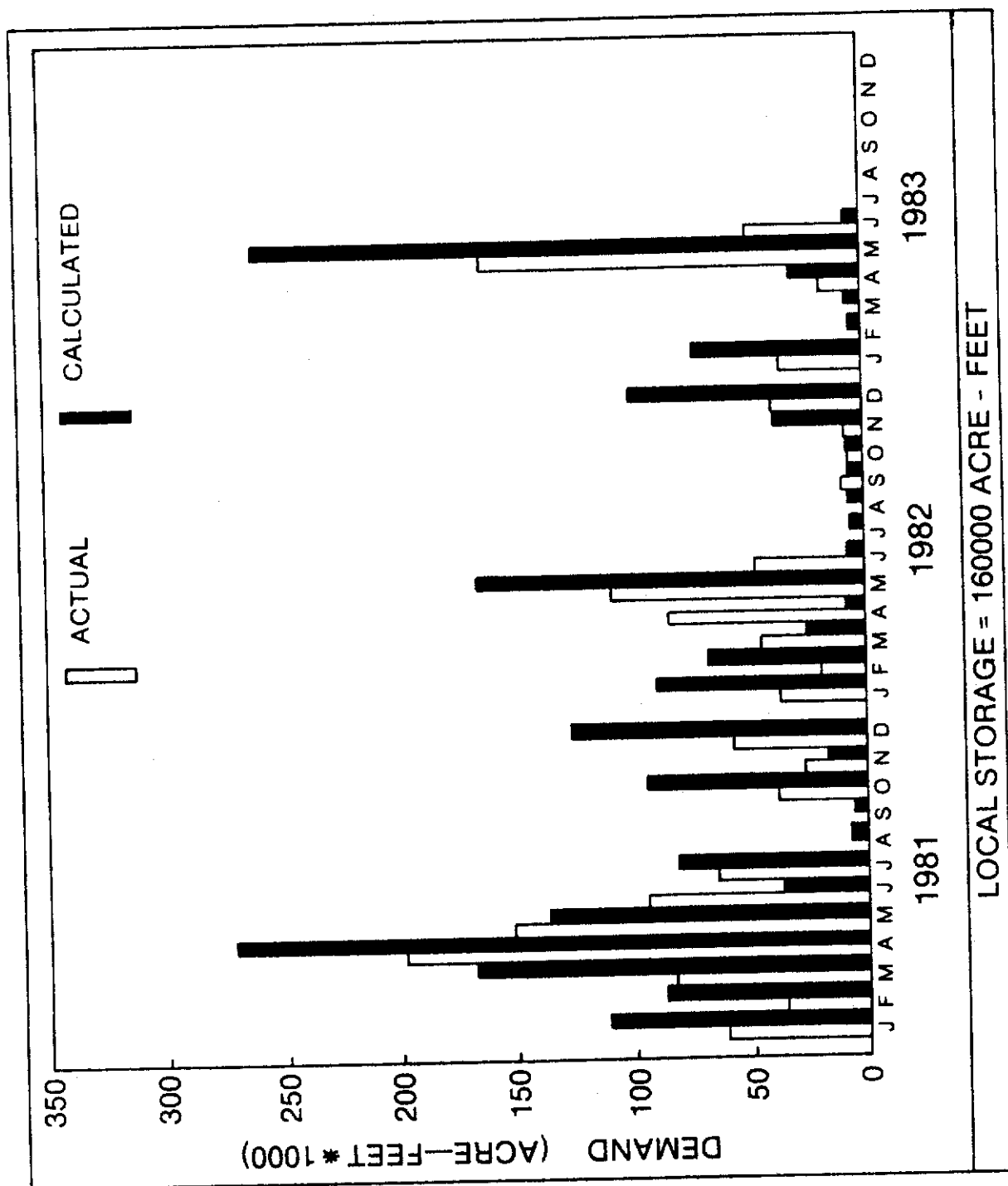


Fig. 15 The Effect of the Local Storage Factors on the Computed Lake Okeechobee Service Area Demands

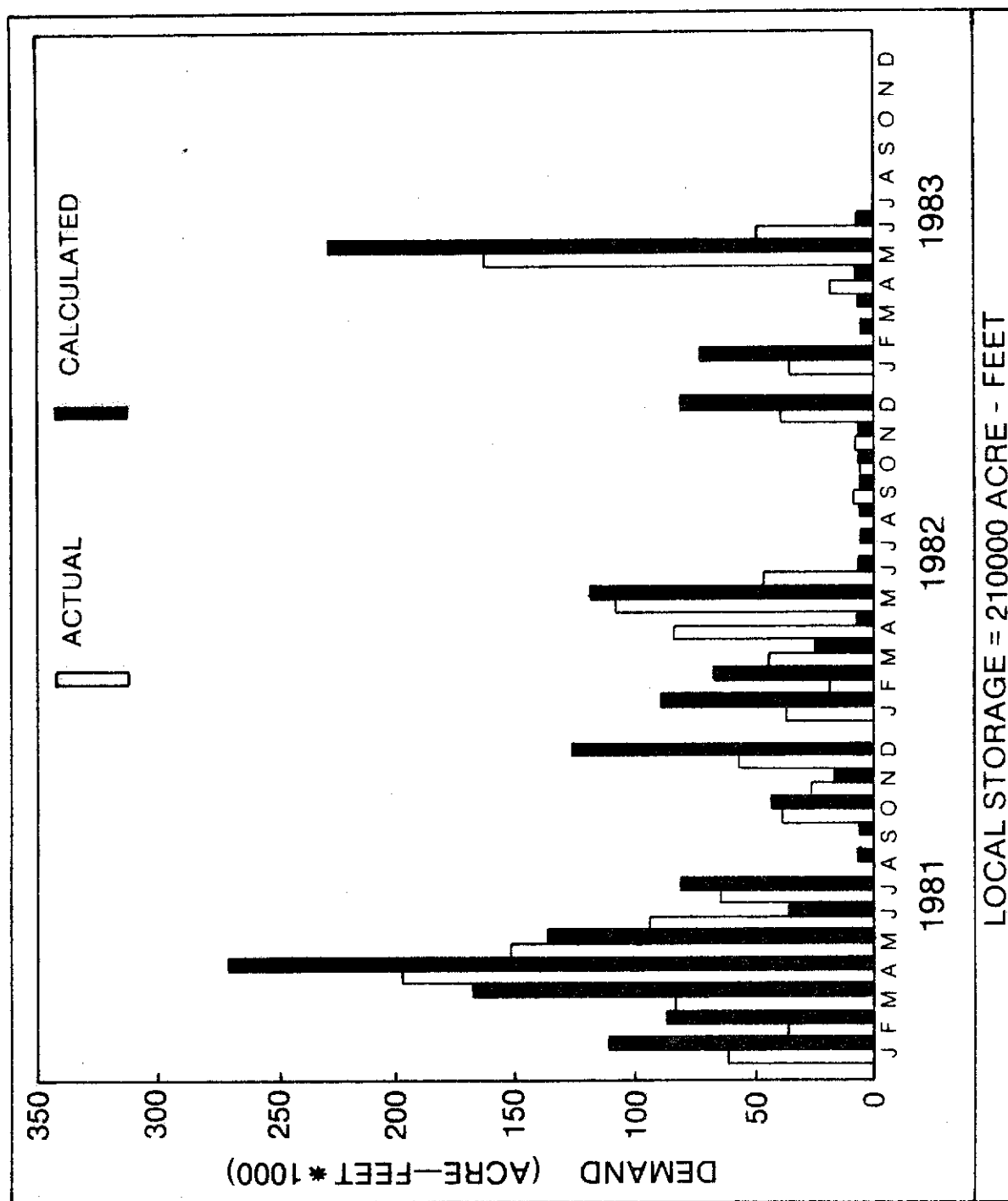


Fig. 16 The Effect of the Local Storage Factors on the Computed Lake Okeechobee Service Area Demands

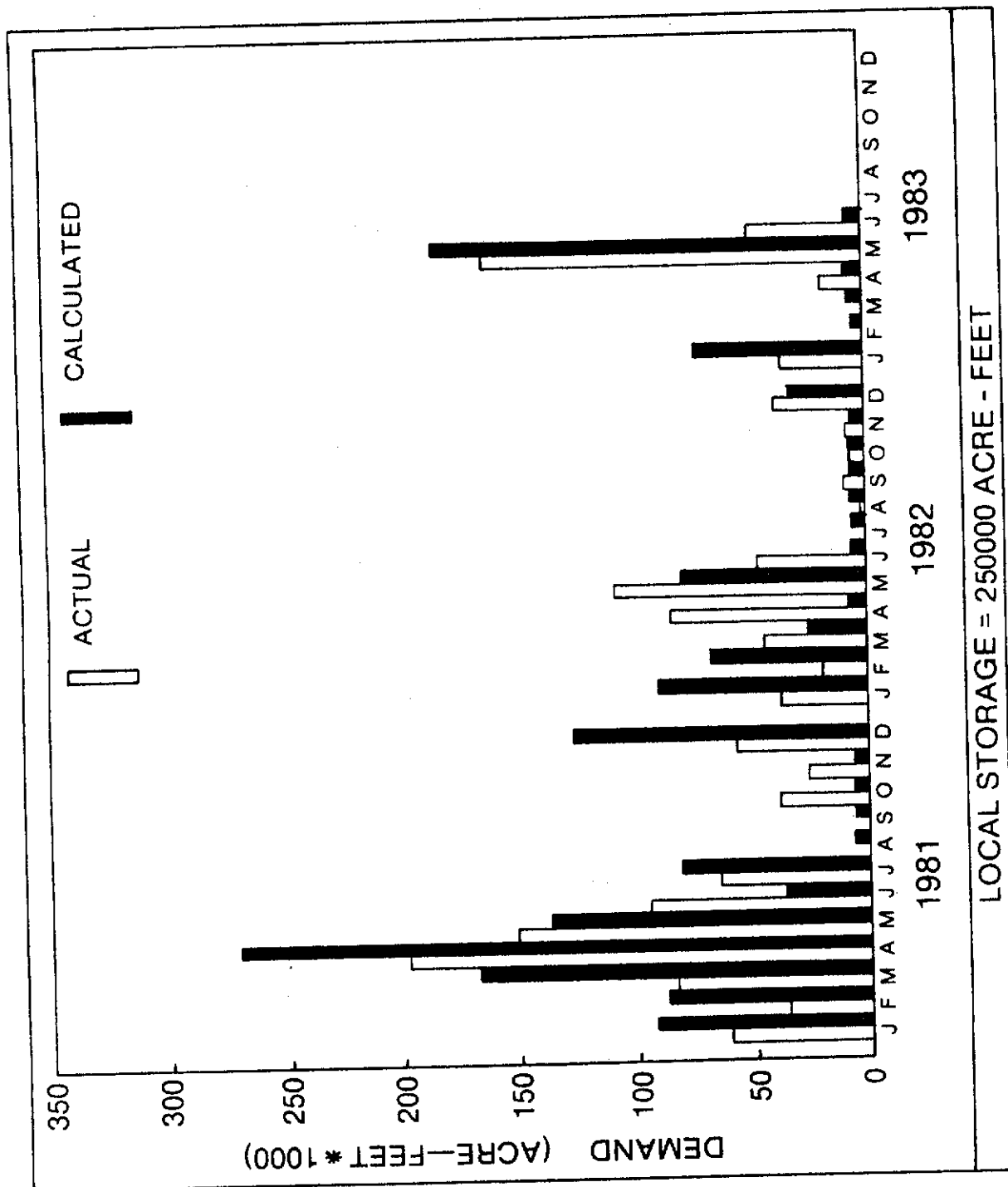


Fig. 17 The Effect of the Local Storage Factors on the Computed Lake Okeechobee Service Area Demands

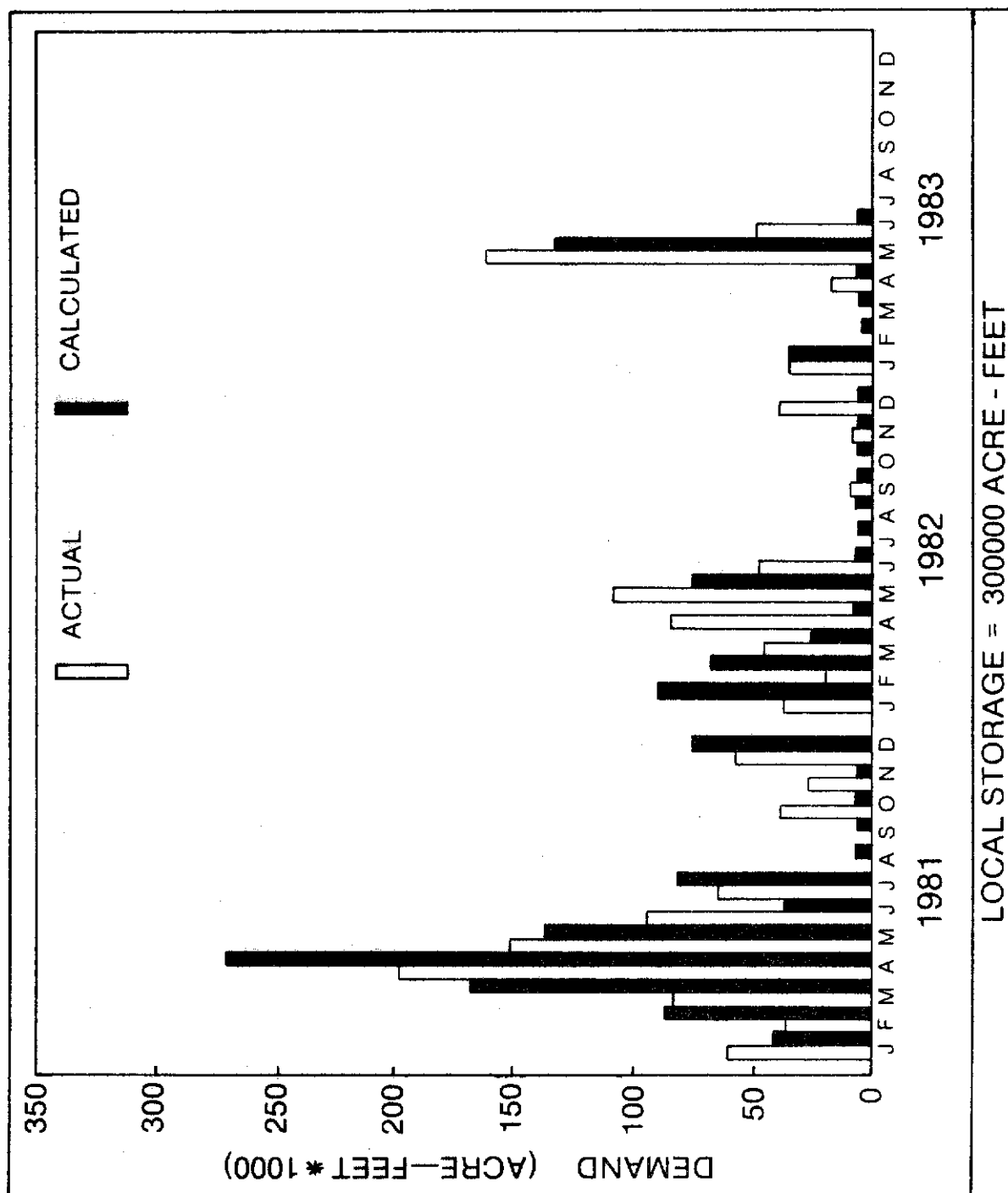


Fig. 18 The Effect of the Local Storage Factors on the Computed Lake Okeechobee Service Area Demands

calibration runs. Simulated stages of Lake Okeechobee compare quite well with the actual stages when these demand estimates are used. This is illustrated in Section 4. Once calibrated, this function is used to calculate demands for the entire model period. Annual estimated demands are plotted in Figure 19.

2. Lower East Coast Service Areas

a. Definition. The Lower East Coast service area demands are somewhat more complex to estimate due to the large transmissivity of the aquifer, the threat of salt water intrusion in the region of the coastal wellfields, and the large variety of water use requirements in the region. Municipalities and many of the agricultural water consumers use the groundwater aquifer along the Lower East Coast for their water supply. The aquifer in this region is deep and porous creating a tremendous source of fresh water; however, due to the threat of salt water intrusion, fresh water levels must be maintained higher than the salt water levels near the interface of the two water types. Under wet conditions this is achieved by the natural processes of groundwater seepage from the Water Conservations Areas and rainfall. Since these service areas are self-sufficient during these wet periods and require no additional fresh water to be supplied from Lake Okeechobee or the Water Conservation Areas, their demand on the regional system is defined to be zero.

During extended dry periods the situation is different. Water pumpage withdrawals increase and ET greatly exceeds rainfall; therefore, groundwater seepage cannot replenish the storage in the vicinity of the wellfields quick enough. The canal system does collect some recharge from groundwater seepage in the western sections of the service area where the groundwater table is generally at a higher elevation due to the existence of the Water Conservation Areas. Once the seepage is collected into the canals, this water travels quickly eastward and becomes recharge for the coastal wellfields. This process is illustrated in Figure 20. At times, however, this recharge is not large enough. Therefore, demand may be defined as the surface water deliveries required from outside the service area necessary to maintain water levels in the major canals at specific levels during dry periods. Added to these demands are the quantities of water consumed directly from the canals by certain agricultural users and municipalities, along with the water that must be supplied for fresh water releases to the estuaries. Numerical simulations in Figure 21 illustrate the complexity of the groundwater conditions in Broward County. In certain cases, even if canals are maintained at specified levels, wellfield

pumpage cutbacks are still necessary to prevent salt water intrusion. These cutbacks are, however, a local problem. The development of the routing model was for the purpose of evaluating regional water supply and distribution.

The water levels in the coastal basins were estimated using an integrated channel-groundwater model. A time step of one day and a spatial resolution of two miles were used in this modeling effort. Actual areal averaged daily rainfall was used for each service area. Present day wellfield pumpage values were collected and assigned to the appropriate nodes of the grid network. Time invariant data defining the physical properties of the study area were also put into the model. Average values for soil type, land use, aquifer depth, permeability, and topography were estimated for each 4 sq mi area. Canal and levee locations were also digitized for each run.

b. Groundwater Flow Estimation. Groundwater flow rates were based on the finite difference approximation of the two dimensional groundwater equation for unconfined aquifers.

$$T_x \frac{\partial^2 h}{\partial x^2} + T_y \frac{\partial^2 h}{\partial y^2} = S \frac{\partial h}{\partial t} + RCHG$$

where

T_x - is transmissivity in the X direction (ft²/sec),

T_y - is transmissivity in the Y direction (ft²/sec),

S - is storage coefficient,

h - is hydraulic head (ft),

$RCHG$ - is net groundwater recharge due to wellfield pumpage, canal seepage, infiltration from surface rainfall, and ET.

c. Channel Flow Estimation. The channel flow model used for estimating coastal demand levels is a mass balance model which calculates seepage into or out of the canal based on the hydraulic gradient between the canal and the groundwater system. When the water level in a channel is calculated to fall below a certain elevation, water must be supplied from one of the Water Conservation Areas to maintain the water levels. Table I indicates the depth above sea level at which each major canal is maintained in the model during the dry periods. The average upstream slope of the water table in the canal is accounted for in this algorithm.

1) Evapotranspiration Estimation. ET is computed as a function of land use, depth to the groundwater table, and average monthly potential evapotranspiration (PET) values. When the groundwater table is near the land surface elevation, ET is assumed

Annual Estimated Demands For Lake Okeechobee

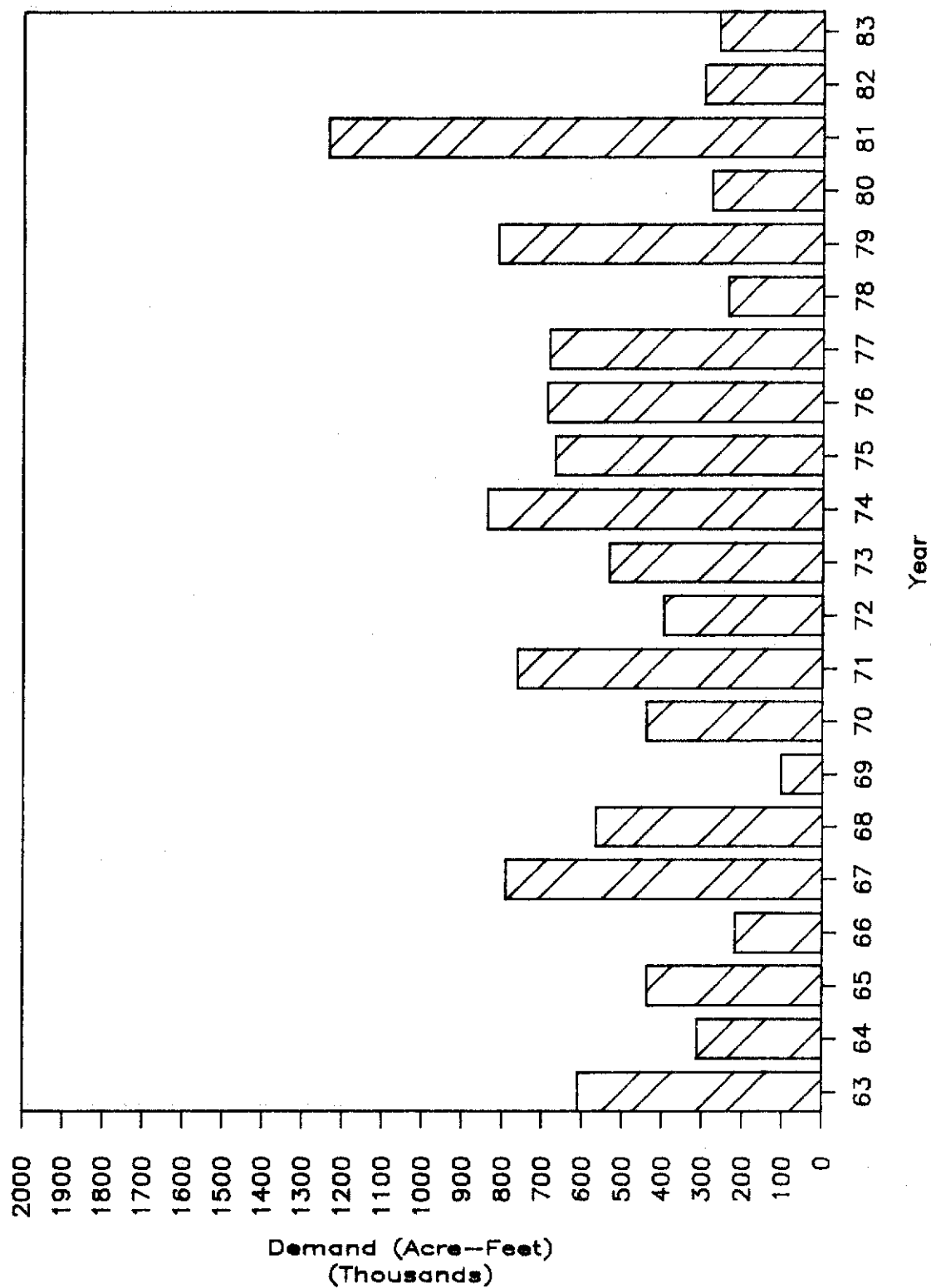


Fig. 19 Bar Plot of the Annual Estimated Demands for Lake Okeechobee

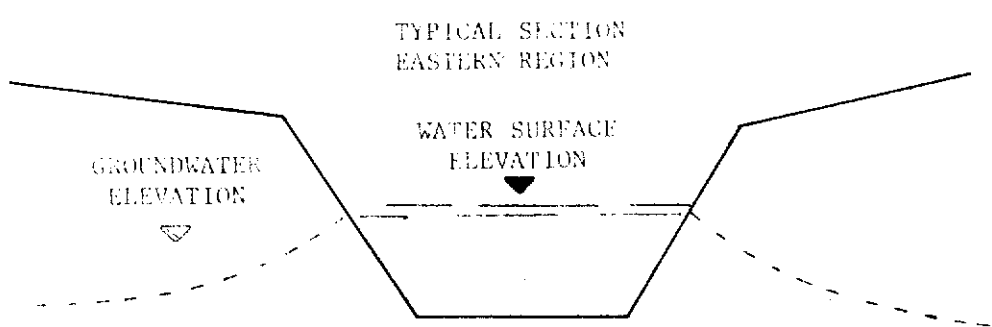
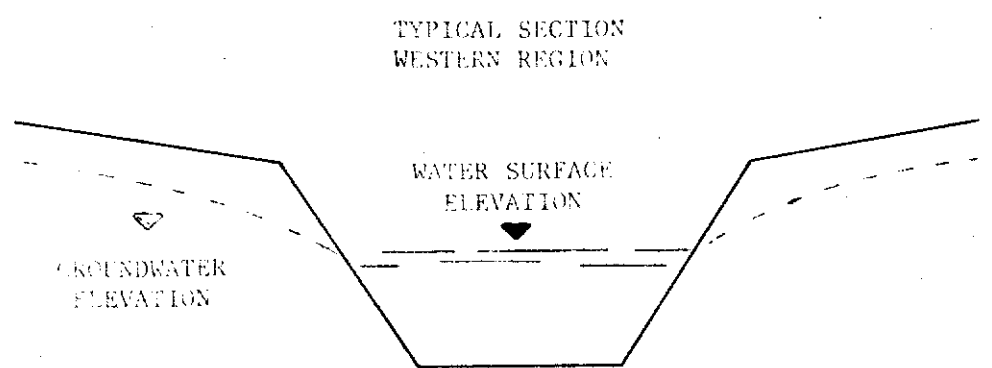
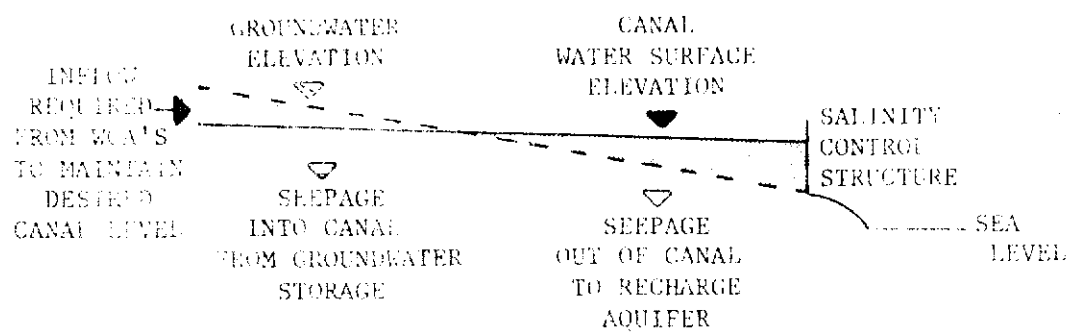


Fig. 20 Diagram of Interflow Between the Groundwater, Canals and Storage Systems

EAST BROWARD CTY

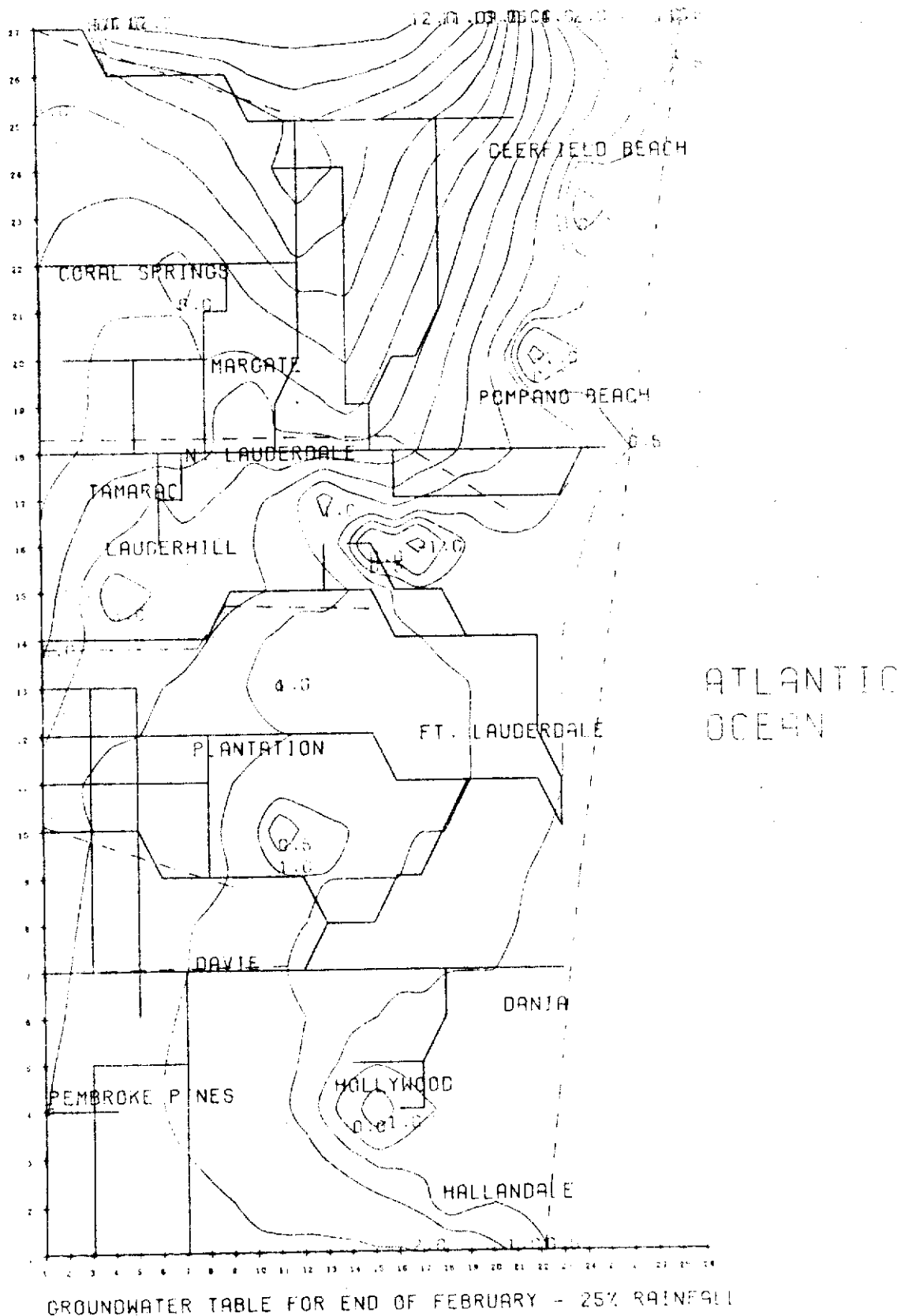


Fig. 21 Simulated Lower East Coast Groundwater Contours

to be at the potential evapotranspiration rate (PET) defined for that specific land use. When the depth to water table increases beyond a specified level, ET is assumed to linearly decrease. The rate of decrease in ET was determined by a calibration process. PET varies for land use and with the time of year. It is computed daily for four different land uses which include urban, agricultural, swamp, and vacant.

2) Boundary Conditions. The eastern boundary condition was easily incorporated as a constant head boundary representing the Atlantic Ocean. The effect of having the Water Conservation Areas on the western boundary was simulated using areal averaged stages for the Water Conservation Areas under base run conditions. The regional groundwater equation does not calculate a large enough seepage out of the Water Conservation Areas. Local effects due to the sharp gradient across the levees are enhanced by the collector canals outside the Water Conservation Areas and have to be accounted for at the boundary. Figure 22 illustrates this local flow condition. This additional water is assumed to enter the collector canals outside the Water Conservation Areas and helps maintain the canal stages along the Lower East Coast. The amount of additional seepage is determined from the seepage coefficients illustrated in Figure 8.

Each service area has a specific surface water reservoir from which to obtain its water supply. Lower East Coast service areas 1, 2, and 3 obtain their water supply from WCA-1, 2A, and 3A respectively. However, during dry periods these Water Conservation Areas may not have any extractable water. At times only localized depression storage, separate from the major canal networks, exists. The water needs of the Lower East Coast must then be met by Lake Okeechobee. The methodology used in this model treats the calculated demands as a sink for the surface water reservoirs. These demands are subtracted from the available storage of the appropriate reservoirs. When deliveries are made from Lake Okeechobee to the Lower East Coast service areas, a portion of the water that leaves the lake is lost to seepage and evaporation; therefore, an efficiency factor must be applied to these calculated flows in the model.

Limitations in the magnitude of the deliveries are also incorporated into the model. These include the physical limitations of the structures and canals, and the limitation of water availability.

B. Regulatory

Lake Okeechobee and each of the Water Conservation Areas have seasonal regulation schedules to follow which maximize their benefits for flood

TABLE 1. CANAL LEVELS MAINTAINED (FT)

Model ID No.	Description	Levels
1	Lake Worth Drainage District	14.0
2	Lake Worth Drainage District	8.0
3	Lake Worth Drainage District	2.0
4	Upstream Deerfield Lock	6.0
5	P. B. Co. (secondary drainage)	8.5
6	P. B. Co. (secondary drainage)	3.0
7	Upstream of S-332 and S-125	3.9
8	C-13	4.2
9	C-14	6.0
10	Coastal Inlet	0.1
11	C-12 Canal	3.5
12	Upstream of Sewell Lock	3.5
13	Coastal Inlet	0.1
14	Upstream of S-124	3.0
15	C-11 secondary drainage	3.5
16	Western C-11	3.5
17	Coastal Inlet	0.1
18	P. B. Co. (second. drainage)	10.0
19	Levee 33 Borrow Canal	2.5
20	Broward Co. (secondary drainage)	3.5
21	Miami Canal upstream of S-26	2.0
22	C-7	1.7
23	C-8	1.8
24	C-9	2.0
25	Upstream of S-335	4.5
26	Levee 31W Borrow Canal	2.0
27	Upstream of S-334	3.5
28	Upstream of S-24A	3.5
29	C-4	2.0
30	Coral Gables	0.5
31	So. Dade (upstream of S-173)	6.0
32	Coastal Inlet	0.1
33	Upstream of S-148	5.2
34	Upstream of S-120	3.5
35	Upstream of S-119	3.4
36	Upstream of S-118	3.8
37	Upstream of S-149	2.9
38	Upstream of S-123	2.3
39	Upstream of S-21	1.8
40	Upstream of S-176	4.5
41	Upstream of S-165	3.3
42	Upstream of S-21A	2.1
43	Upstream of S-20G	2.1
44	Upstream of S-166	3.1
45	Upstream of S-167	3.4
46	Upstream of S-179	2.6
47	Upstream of S-20F	1.2
48	So. Dade (secondary drainage)	0.5
49	So. Dade (secondary drainage)	0.5
50	L-31E Borrow Canal	1.2
51	Upstream of S-177	3.3
52	Upstream of S-18C	2.3
53	Upstream of S-199	2.0
54	Upstream of S-18	2.0
55	Upstream of S-197	1.5
56	P. B. Co. (secondary drainage)	14.0
57	P. B. Co. (secondary drainage)	12.0
58	Upstream of S-37A	0.5
59	Upstream of S-13	1.6
60	Coastal Inlet	0.1
61	Coastal Inlet	0.1
62	Coastal Inlet	2.9
63	Lake Worth Drainage District	12.0
64	C-51	8.0
65	Lake Worth Drainage District	10.0

protection and for fulfillment of water use requirements, while attempting to generate hydrological conditions favorable for the natural ecosystem.

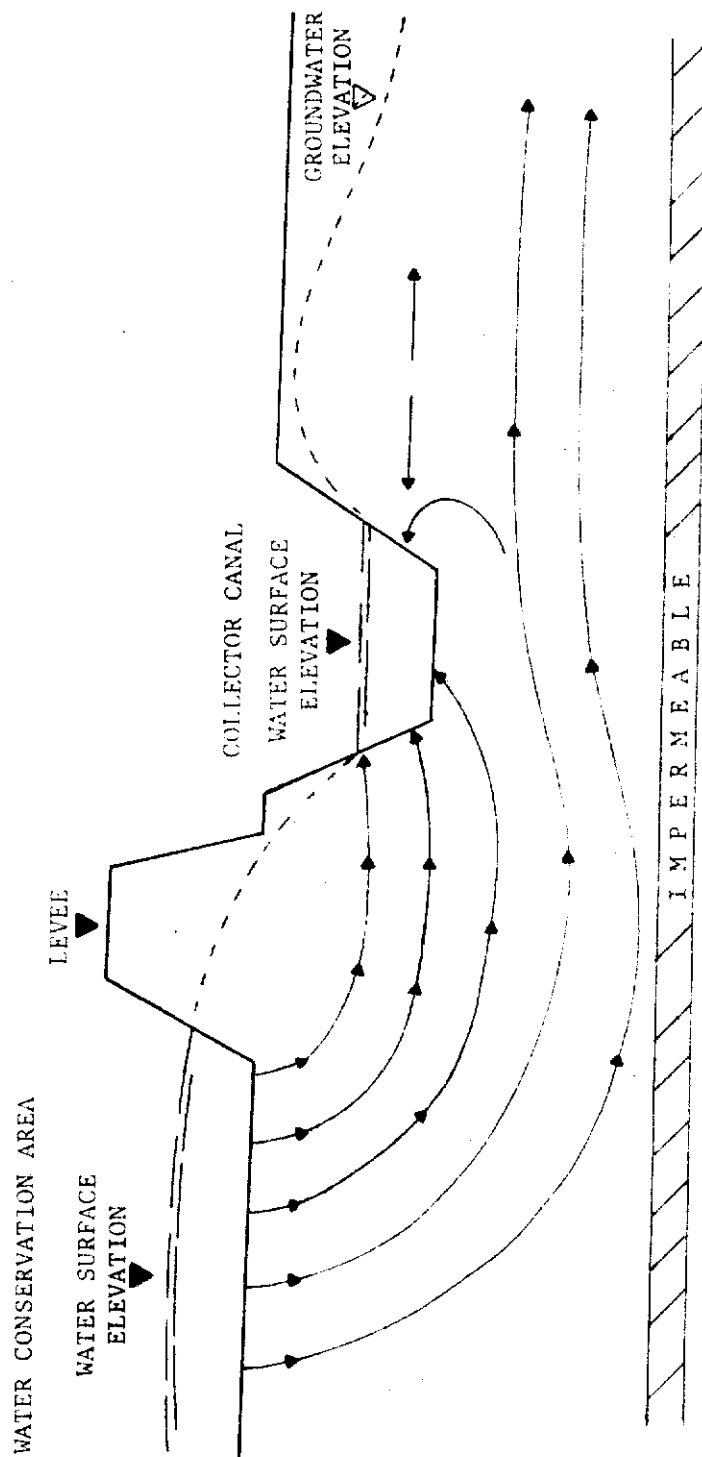


Fig. 22 Diagram of the Flow Pattern Across a Typical Section of Levee

When water levels exceed these regulation schedules, releases are made out of the reservoir in order to guarantee flood protection.

When Lake Okeechobee is above regulation schedule, water may be released to the Water Conservation Areas if they are below schedule and local runoff from the EAA is minimal. Other regulatory releases are required through the St. Lucie Canal and the Caloosahatchee River in an attempt to maintain safe water levels. When the stage in Lake Okeechobee enters Zone B, discharges that are only a fraction of maximum capacity are made through the St. Lucie Canal and the Caloosahatchee River in an effort to prevent erosion in these outlets and ecological damage to the downstream estuaries. However, if the lake stage enters Zone A, maximum releases must be made from Lake Okeechobee for flood protection of the area surrounding the lake.

WCA-1 may release water eastward through the West Palm Beach and the Hillsboro Canals. These routes are limited, however, depending on water conditions along coastal regions. The primary regulation releases are made through the S-10 structures into WCA-2A.

WCA-2A may also release water to the east through the Cypress Creek and North New River Canals. Presently, a drawdown schedule is imposed in Water Conservation Area 2A for the purpose of re-establishment of the tree islands. These releases are again restricted by coastal water conditions. The primary regulatory discharge from WCA-2A is through the S-11 structures to WCA-3A.

WCA-3A may release water into WCA-3B through the S-151 structure and to the Everglades National Park through the S-12 and S-333 structures. The present Water Conservation Area 3A schedule is an experimental schedule which attempts to return flow patterns back to more natural conditions under this plan. A portion of the deliveries to Everglades National Park are made through S-333 to the Northeast Shark River Slough in an effort to restore the slough. Other deliveries to Everglades National Park are made through the L-28 culverts and the S-12, S-332, and S-18C structures. The temporal distribution and amount of these deliveries are determined as a function of rainfall and Water Conservation Area 3A average stage. Table 2 summarizes the Water Conservation Area 3A operational guidelines for the regulation schedule that appears in Figure 23c. This plan is based on the premise that changes in discharge rates should usually occur gradually. WCA-3A may also release water through WCA-3B to the Atlantic Ocean, except during rainy periods along coastal

regions. Flows out of one region and into another are subtracted and added to the storage of the appropriate reservoir. Figure 23a through 23c depicts the seasonal variation of the regulation schedules for Lake Okeechobee and the Water Conservation Areas.

C. Conveyance Limitations

Water deliveries from one region to another are made for water supply and flood protection purposes. However, during periods of extreme wetness or dryness, conveyance capacities may limit the amount of water that can be delivered from one region to another. This may cause the water levels in certain regions to rise above schedule during wet periods or may cause shortages in certain regions during dry periods. The purpose of this section is to discuss the conveyance limitations incorporated in the routing model. These conveyance limitations were chosen to simulate the average discharge conditions on a monthly or seasonal basis, and do not incorporate all the combinations of hydraulic conditions that may exist for shorter periods of time. Many of the relationships for determining headwater and tailwater stages are based on historical stage and discharge data and are only valid for this range data. Figures 24a and 24b illustrate the locations of major structures in the study area.

1. Lake Okeechobee

Principal regulatory releases from Lake Okeechobee are made through the Caloosahatchee River and the St. Lucie Canal. Other releases may also be made through the West Palm Beach, Hillsboro, North New River, and Miami Canals to the Water Conservation Areas if the Water Conservation Areas are below schedule.

The estimated discharge capacities through the EAA are limited by the water use and flood protection requirements of the EAA. The assumptions incorporated into this model are: 1) that no deliveries may pass through the EAA on days when there is net runoff from the EAA, and 2) that the relationships discussed in the following subsections for releases from Lake Okeechobee to the Water Conservation Areas will be adjusted to account for the water use in the EAA.

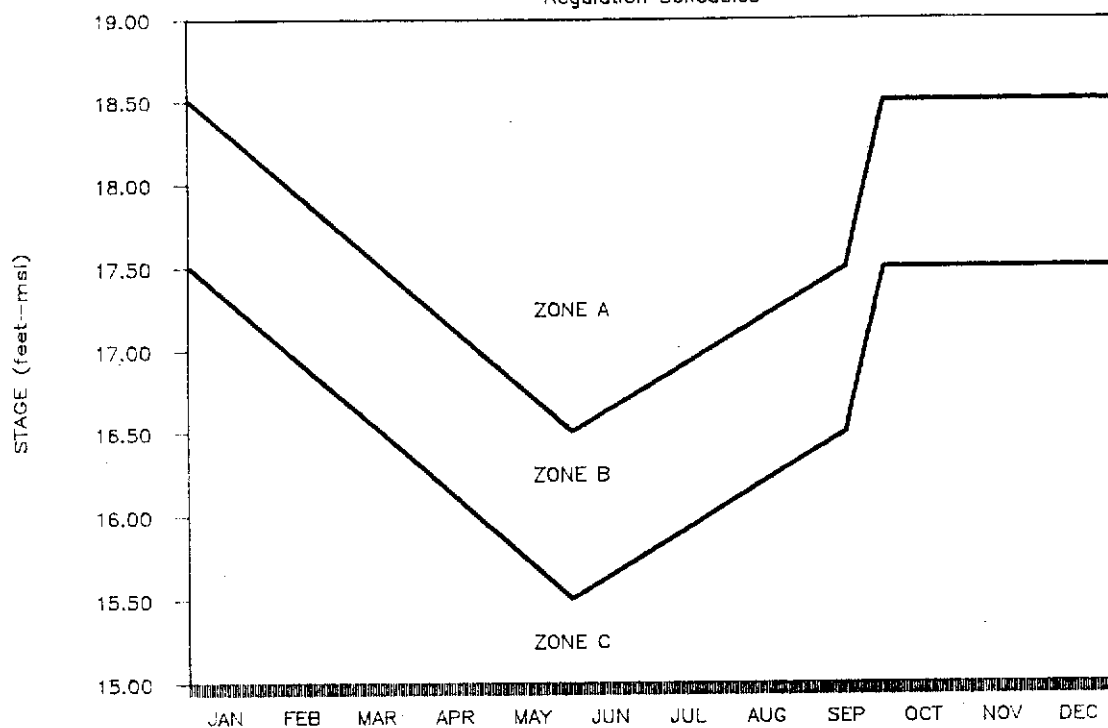
a. St. Lucie Canal: Flows through the St. Lucie Canal are regulated by the S-308 and S-80 structures. Discharge capacity at S-80 is a function of the Lake Okeechobee stage when S-308 is open. This relationship appears in graphical form in Figure 25. Under present operational policy, discharges are limited to 2,500 cfs at S-80 when the lake initially exceeds regulation schedule (Zone B discharges).

TABLE 2 WCA-3A OPERATIONAL GUIDELINES

	S-12	S-333	S-151	L-28 CULVERTS
Zone A	Open Full	Maximum allowable discharge	Maximum diversion to 3B when 3B stage is less than 8.5 feet	S-343A & B and S-344 open full if no problems downstream
Zone B	S-333 Open; Discharge 45% of computed flow S-333 Closed; Discharge at least 73% of computed flow (up to 100% if desired by ENP)	Discharge up to 55% of computed flow when permitted by this agreement.	Same as Zone A whether S-333 is open or closed.	Same as Zone A whether S-333 is open or closed.
Zone C	S-333 Open; Discharge 45% of computed flow S-333 Closed; Discharge 45% of computed flow plus all or part of S-333's amount if desired by ENP	Same as Zone B	May be used to divert water from WCA-3A whether S-333 is open or closed.	May be used to divert water from WCA-3A whether S-333 is open or closed.
Zone D	S-333 Open; Discharge 45% of computed flow. S-333 Closed; Discharge 45% of computed flow plus all or part of S-333's amount if desired by ENP.	Same as Zone B	Used only for water supply deliveries to Dade County.	Closed
Zone E	Discharge 45% of computed flow whether S-333 is open or closed.	Same as Zone B	Used only for water supply deliveries to Dade County	Closed

LAKE OKEECHOBEE

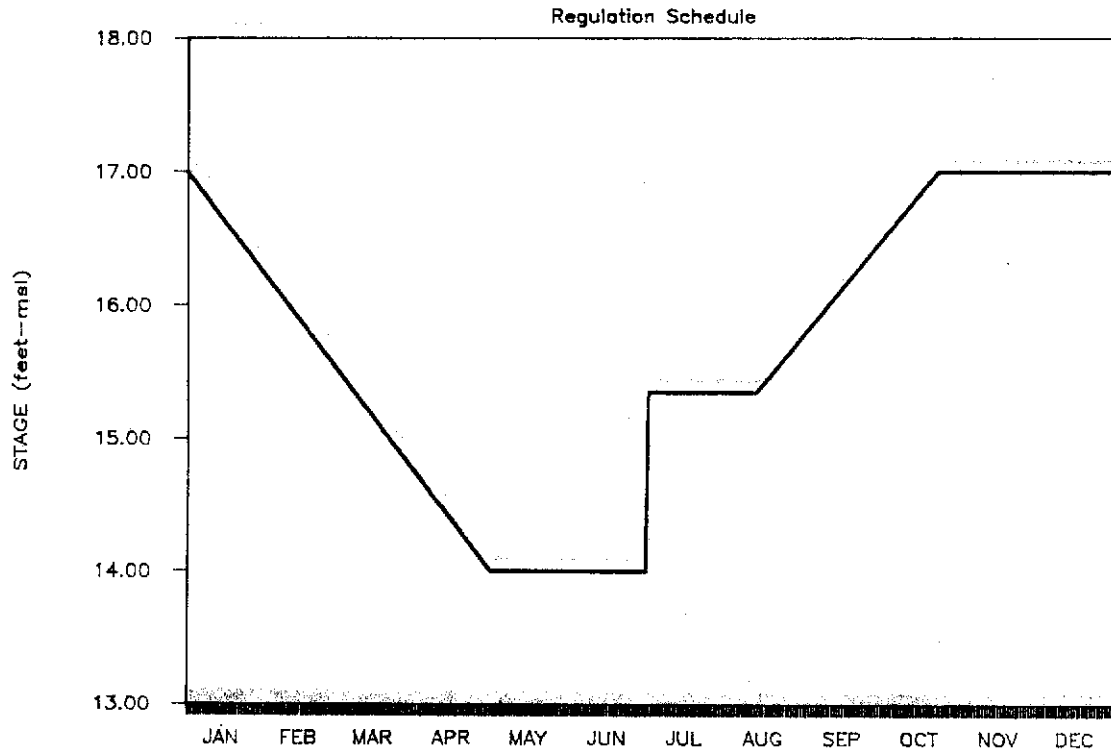
Regulation Schedules



ZONE	AGRICULTURAL CANALS	CALOOSAHATCHEE RIVER	ST. LUCIE CANAL
A	Pump maximum practicable to conservation areas for regulation after removal of local runoff	Up to maximum capacity(9,300 c.f.s. at S-77)without local flooding	Up to maximum discharge at S-308C
B	Same as above	Up to 4,500 c.f.s	Up to 2,500 c.f.s at S-80, except when exceeded by local inflow
C	No regulatory discharge	No regulatory discharge	No regulatory discharge
	First Priority	Second Priority	Third Priority

Fig. 23a Graphical Representation of the Regulation Schedules

WATER CONSERVATION AREA 1



WATER CONSERVATION AREA 2A

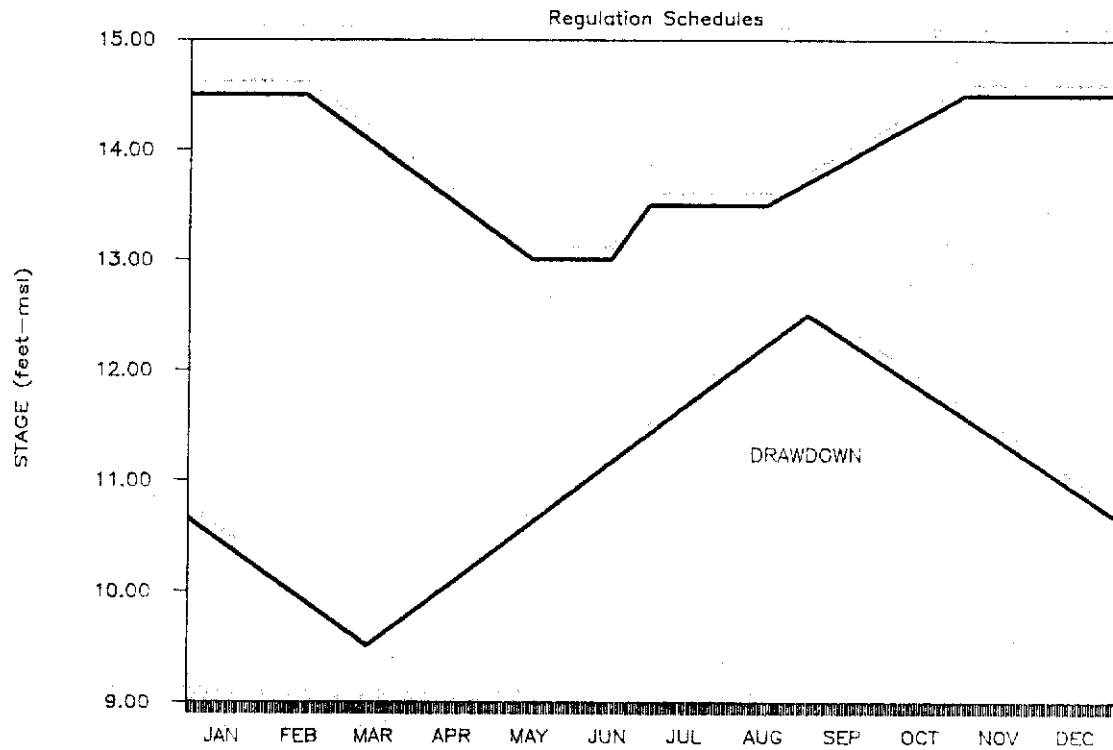
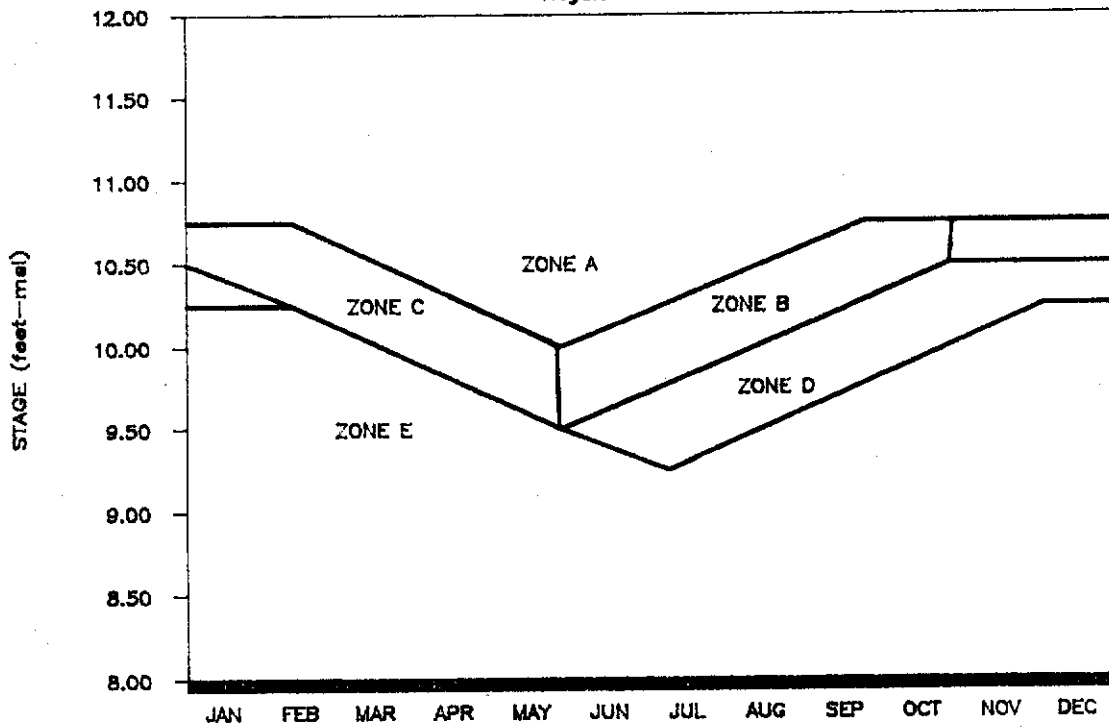


Fig. 23b Graphical Representation of the Regulation Schedules

WATER CONSERVATION AREA 3A

Regulation Schedules



ZONE A FLOOD OPERATIONS

ZONE B UPPER TRANSITION ZONE - WET SEASON

ZONE C UPPER TRANSITION ZONE - DRY SEASON

ZONE D LOWER TRANSITION ZONE

ZONE E RAINFALL FORMULA ONLY

Fig. 23c Graphical Representation of the Regulation Schedules

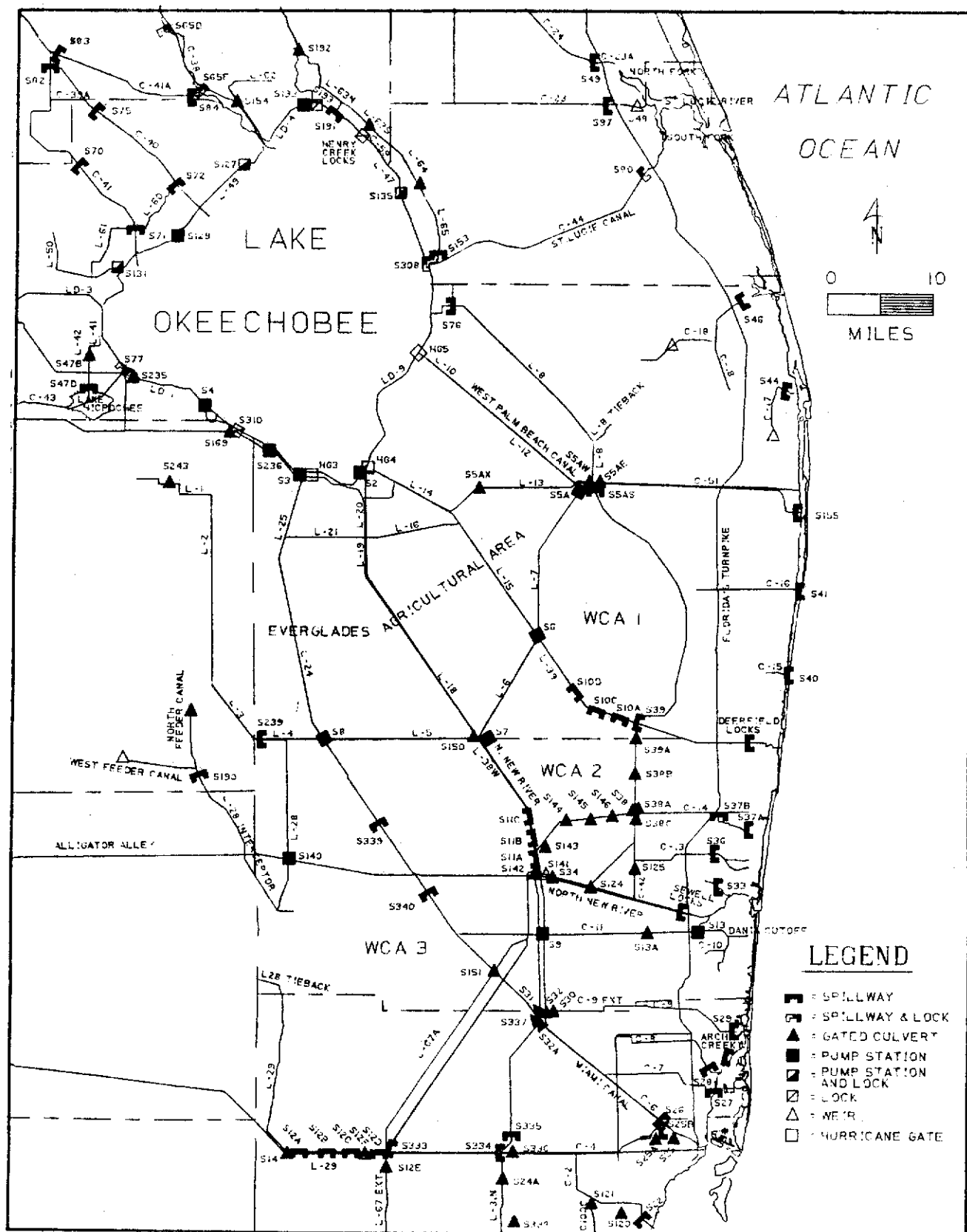


Fig. 24a Detail Map of Structures and Canal Locations

ST. LUCIE CANAL AT LAKE OKEECHOBEE OBSERVED RATING

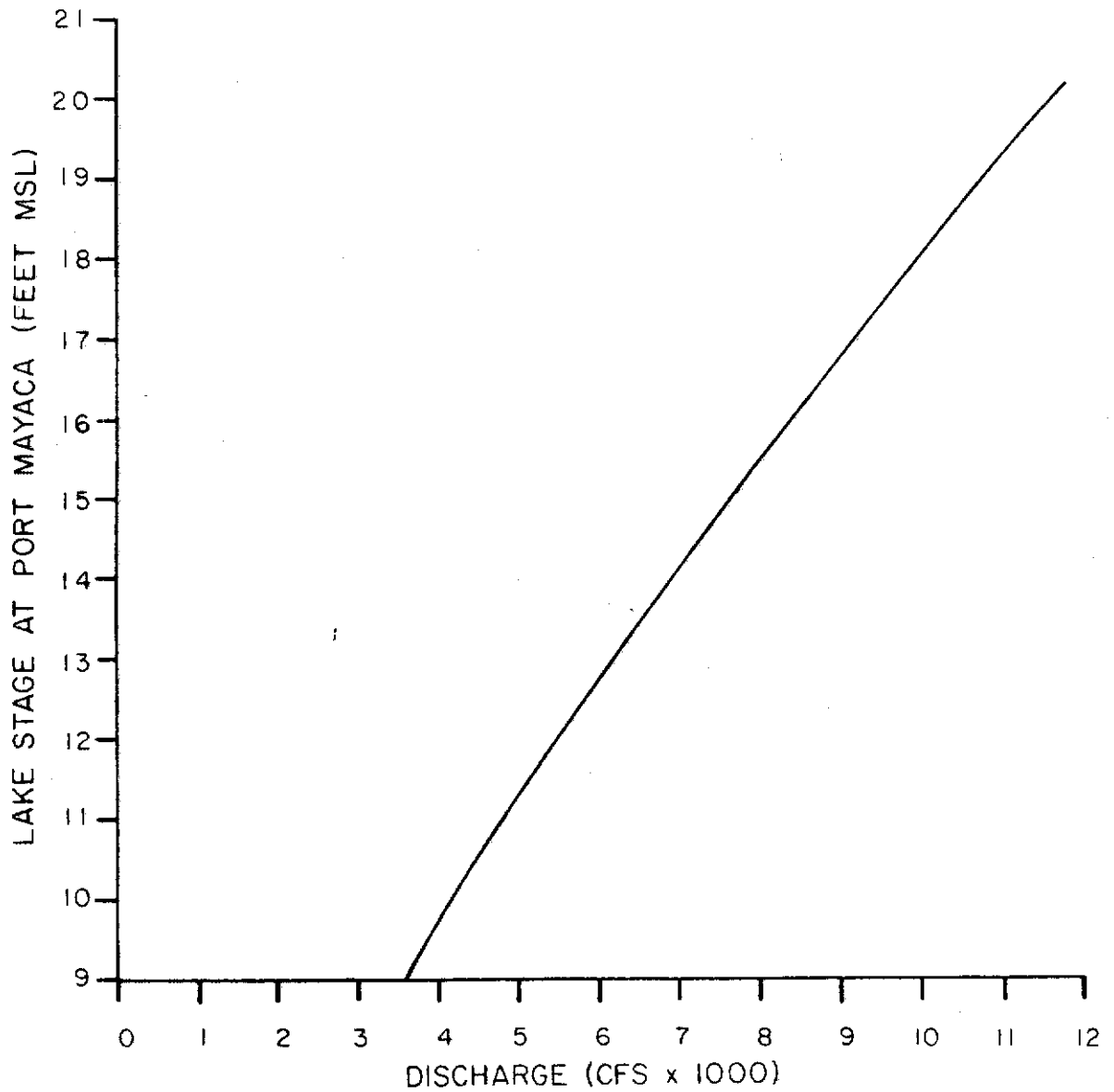


Fig. 25 Discharge Capacity at S-80 versus the Stage in Lake Okeechobee

Larger discharges are made only when Lake Okeechobee exceeds its schedule by more than a foot (Zone A discharges). Historically these larger discharges have been estimated to be as high as 11,500 cfs for a period of one day; however, they rarely exceed 9,000 cfs and average about 7,200 cfs. Therefore, 7,200 cfs is the value used as the maximum discharge capacity in the base run for S-80. The amount of water that actually leaves Lake Okeechobee through S-308 is somewhat less due to local runoff collected from the St. Lucie basin. This runoff is estimated from the rainfall-runoff curve that appears in Figure 11. Water use releases to the St. Lucie Canal are always well within conveyance limitations.

b. Caloosahatchee River: Flows from Lake Okeechobee to the Caloosahatchee River are controlled by S-77. Like the St. Lucie Canal, flows are limited when the lake exceeds schedule to avoid erosion. Discharges of 4,500 cfs are made when Lake Okeechobee initially exceeds schedule; however, if the lake continues to rise by more than a foot above schedule, releases are increased up to the maximum capacity of S-77. Design capacity of S-77 is 9,300 cfs. Actual historical data indicates that 7,800 cfs is an average Zone A discharge; therefore, 7,800 cfs was used as a maximum capacity of the Caloosahatchee River in the base run. Water supply deliveries are well within the limits of this structure.

c. Miami Canal: The Miami and North New River Canals have recently been excavated to increase flow capacities from Lake Okeechobee to the Water Conservation Areas. The discharge curve for gravity flow from Lake Okeechobee to WCA-3A via the Miami Canal appears in Figure 26. Additional conveyance capacity may be available when the pumps at the S-3 and S-8 pump stations are in operation; however, these are normally used for pumping storm runoff from the Everglades agricultural region and not for delivering water from Lake Okeechobee to WCA-3A. Therefore, this additional capacity is not presently considered in the routing model. The relationship used to estimate maximum flow capacity from Lake Okeechobee to WCA-3A is:

$$QM = (1543.17 * LOK^3 - 1587.5 * S8TW^3 - 25220 * (LOK - S8TW)^{3/2} - .381 * (10)^7 * LOK + 399227)^{1/2} \quad (21)$$

where

QM - is the maximum flow capacity from the lake to WCA-3A (cfs) through the Miami Canal,

LOK - is the lake stage (ft), and

S8TW - is the WCA-3A stage at S-8 (ft).

The correlation between the actual design discharge curves and those calculated by Equation 21 as measured by the statistical parameter r^2 is .9997. The S-8 tailwater stage is estimated from the average WCA-3A stage and the previous day discharge by the following relationship:

$$S8TW = .05350 * SQRT(QS8) + .0298 * AVG3A^2 + 7.53 \quad (22)$$

where

S8TW - is the S8 tailwater stage (ft),

QS8 - is the previous day S8 discharge (cfs), and

AVG3A - is the average stage in WCA-3A (ft).

This relationship was determined by a statistical analysis of historical data. Initially the period of record between 1963 and 1983 was used for the analysis. However, due to the many changes to this Water Conservation Area over the years, the remaining analysis was rerun using data only from 1980 to 1983. In fact, this improved the standard error obtained from .56 to .46, and increased the statistical correlation parameter from .86 to .87. Further improvement is likely if the operation of the S-339 and S-340 structures are included in the relationship. The majority of the data used for determining the relationship in Equation 22 was obtained prior to the existence of S-339 and S-340 and, therefore, this relationship should only be used if S-339 and S-340 are assumed to be open wide. This relationship should be valuable in determining the limitations on deliveries to the Lower East Coast Service Area 3A, and Everglades National Park; however, it probably will not be adequate for determining environmental releases to the northern portion of WCA-3A when S-339 and S-340 are closed. Days when WCA-3A was below 8.5 ft MSL were excluded from the step-wise regression because of the poor correlation between the tailwater stage and the three gage average (3-3, 3-4, 3-28). Water levels are approaching ground levels below 8.5 and, therefore, do not correlate well with canal stages; however, this is not critical because when WCA-3A falls below 8.5 ft, the stage in Lake Okeechobee is the principal factor which determines the maximum discharge capacity as illustrated in Figure 26.

d. North New River Canal: The discharge curve for the North New River Canal between Lake Okeechobee and the Water Conservation Areas appears in Figure 27. The functional representation of this curve incorporated into the model is:

$$QNNR = (1423.07 * LOK^3 - 1331.59 * S7TW^3 + 179454.9 * S7TW - .15511 * (10)^7 * LOK^{1/2} + 3069177) \quad (23)$$

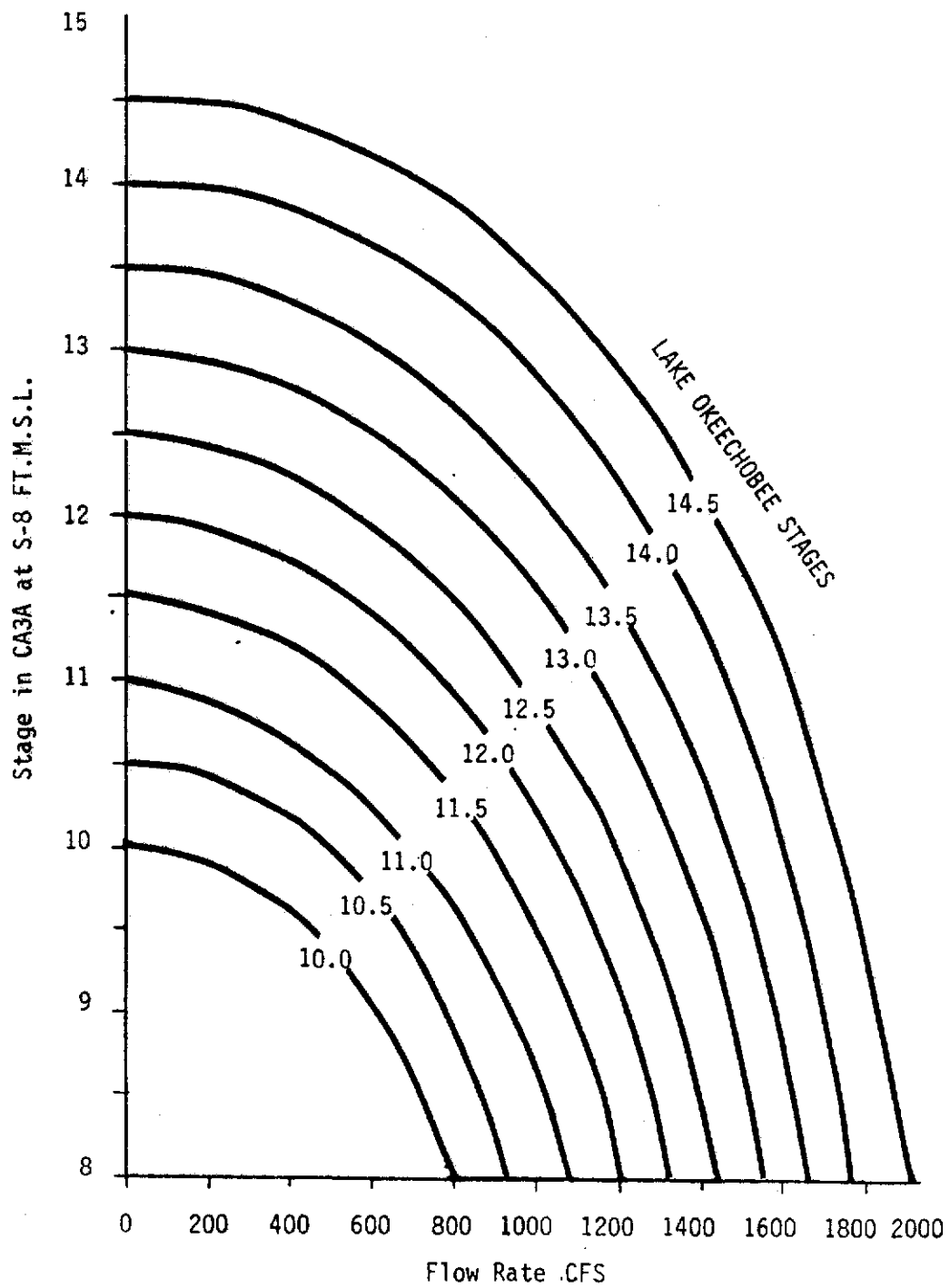
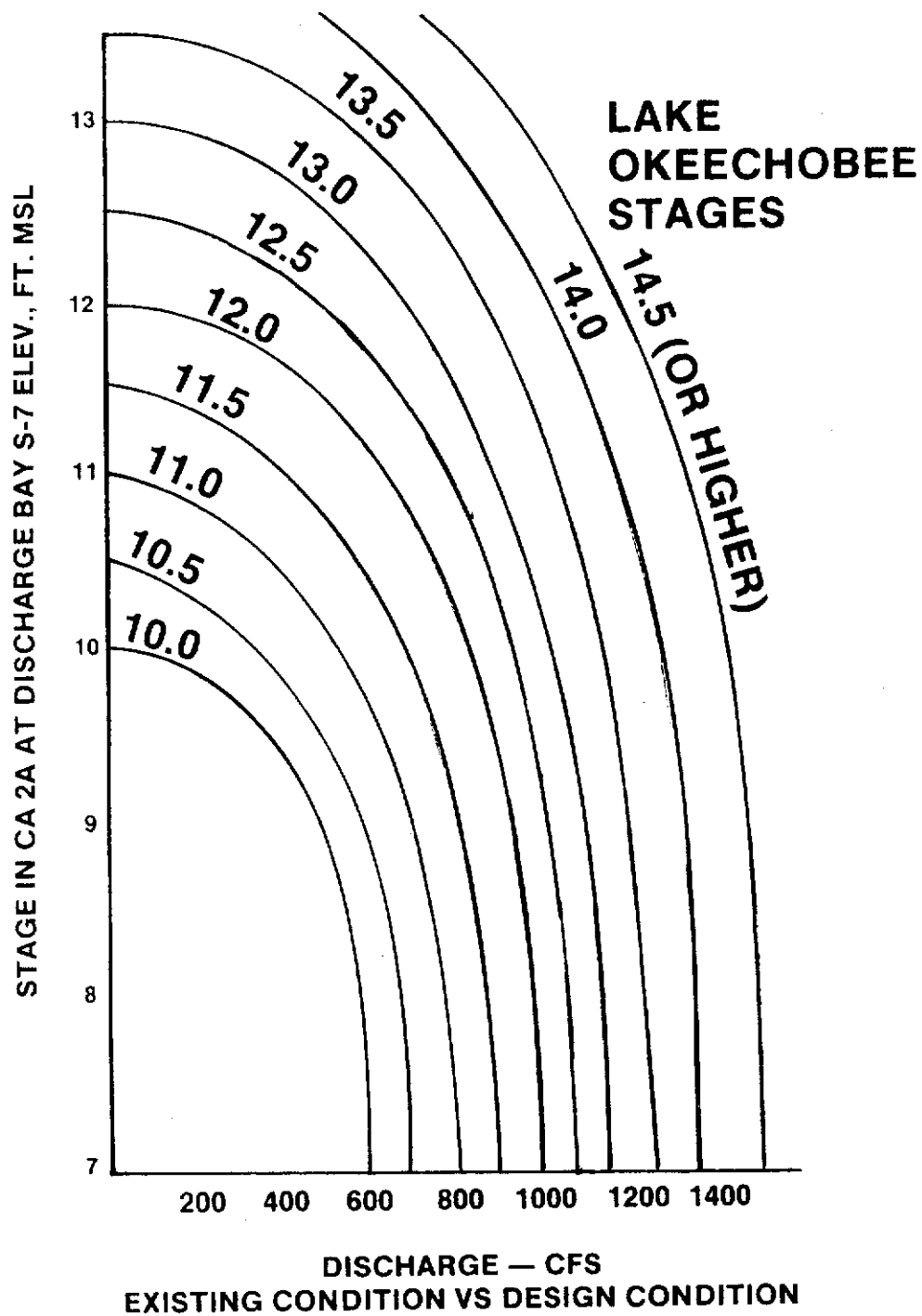


Fig. 26 Gravity Flow from Lake Okeechobee to WCA-3A via Miami Canal

*General Design Memorandum Part I, Supp. 51, Plate 9



GRAVITY PERFORMANCE

Fig. 27. Gravity Flow from Lake Okeechobee to WCA-2A via North New River Canal. *General Design Memo Part I, Supp. 51, Plate 10

where

- QNNR - is the maximum discharge capacity between Lake Okeechobee and WCA-2A via the North New River Canal (cfs),
LOK - is Lake Okeechobee's average stage (ft), and
S7TW - is WCA-2A stage at S-7 (ft).

The correlation between the design capacity curves and the functional representations as measured by the statistical parameter r^2 is .9977.

The S-7 tailwater stage was determined from the average stage in WCA-2A and the previous day's discharge through S-7 by the expression:

$$S7TW = 48.03 * \text{LOG}(AVG2A) + .00071 * QS7 - .00089 * AVG2A - 38.97 \quad (24)$$

where

- S7TW - is the tailwater stage at S-7 (ft),
QS7 - is the previous day discharge through S-7 (cfs), and
AVG2A - is the average stage in WCA-2A (ft).

A correlation coefficient (r^2) of .82, and a standard error of .46 ft were obtained with this relationship when compared to actual historical data from the period 1963 to 1983. Using only recent data did not significantly change the value of r^2 or standard error. When the average stage in WCA-2A falls below ground elevation at gate 2-17, the relationship in Equation 24 has little meaning. This is not critical, however, because during periods of low stages in WCA-2A the discharge capacity from Lake Okeechobee to WCA-2A through the North New River Canal is primarily a function of lake stage.

e. Hillsboro Canal: Historical maximum flows from Lake Okeechobee to WCA-1 via the Hillsboro Canal were about 600 cfs. The Hillsboro Canal must be maintained 10 ft above mean sea level at the S-6 pump in order for the pump to operate. Assuming that there is a 2 ft head loss between Lake Okeechobee and WCA-1 along the Hillsboro canal, the lake must be above 12 ft mean sea level in order to operate this pump for water supply purposes. Otherwise flow capacity from Lake Okeechobee to WCA-1 via the Hillsboro Canal is assumed to be zero. Therefore, the maximum flow capacity incorporated into the model is as follows: when the lake is above 13 ft mean sea level, the maximum discharge capacity is 600 cfs; when the lake is below 12 ft mean sea level, the discharge capacity is zero, and between these two stages the

capacity is assumed to linearly increase from 0 cfs to 600 cfs as the stage rises in the lake.

f. West Palm Beach Canal: Flow capacity through the West Palm Beach Canal is greater than 4000 cfs. However, the discharge capacity at Hurricane Gate 5 is a function of Lake Okeechobee stage, the stage in the West Palm Beach Canal, and the gate opening at the structure. This relationship may be represented by:

$$QH5 = Q_{11} * DC * (HW - TW)^{1/2} \quad (25)$$

where

- QH5 - is the actual discharge capacity of the hurricane gate structure (cfs),
Q₁₁ - is the discharge capacity as a function of gate opening before adjustments (cfs),
DC - is an adjustment for depth of water (depth coefficient),
HW - is headwater stage at the structure, (ft), and
TW - is tailwater stage at the structure (ft).

Q₁₁ and DC may then be determined from the Corps of Engineers' rating curves illustrated in Figures 28 and 29 respectively. The equation used to represent flow capacity through Hurricane Gate 5 becomes:

$$QH5 = 8.75 * GO * (.073 * LOK - .168) * (LOK - TWH5)^{1/2} \quad (26)$$

where

- QH5 - is the discharge capacity through Hurricane Gate 5 (cfs),
LOK - represents Lake Okeechobee stage (ft),
GO - is the gate opening at Hurricane Gate 5 (ft), and
TWH5 - is the structure tailwater stage in the West Palm Beach Canal (ft).

The tailwater stage under normal conditions is assumed to be maintained at 12 ft. However, when the lake stages fall to abnormally low levels, the canal level may also drop due to conveyance limitations and a need to conserve water. During these dry periods if the canal stage drops too low the S-5A pump capacity will be limited. Once the intake stage at the S-5A pump falls below 9 ft (MSL), the ability of the pump to deliver water to WCA-1 no longer exists. Due to the head loss across the EAA in the West Palm Beach Canal, the tailwater stage at Hurricane Gate 5 that corresponds to a 9 ft intake stage at S-5A is about 11 ft. Therefore, if the lake stage falls below 11 ft (MSL), water will not be able to be passed from Lake Okeechobee to WCA-1 via the West Palm Beach Canal.

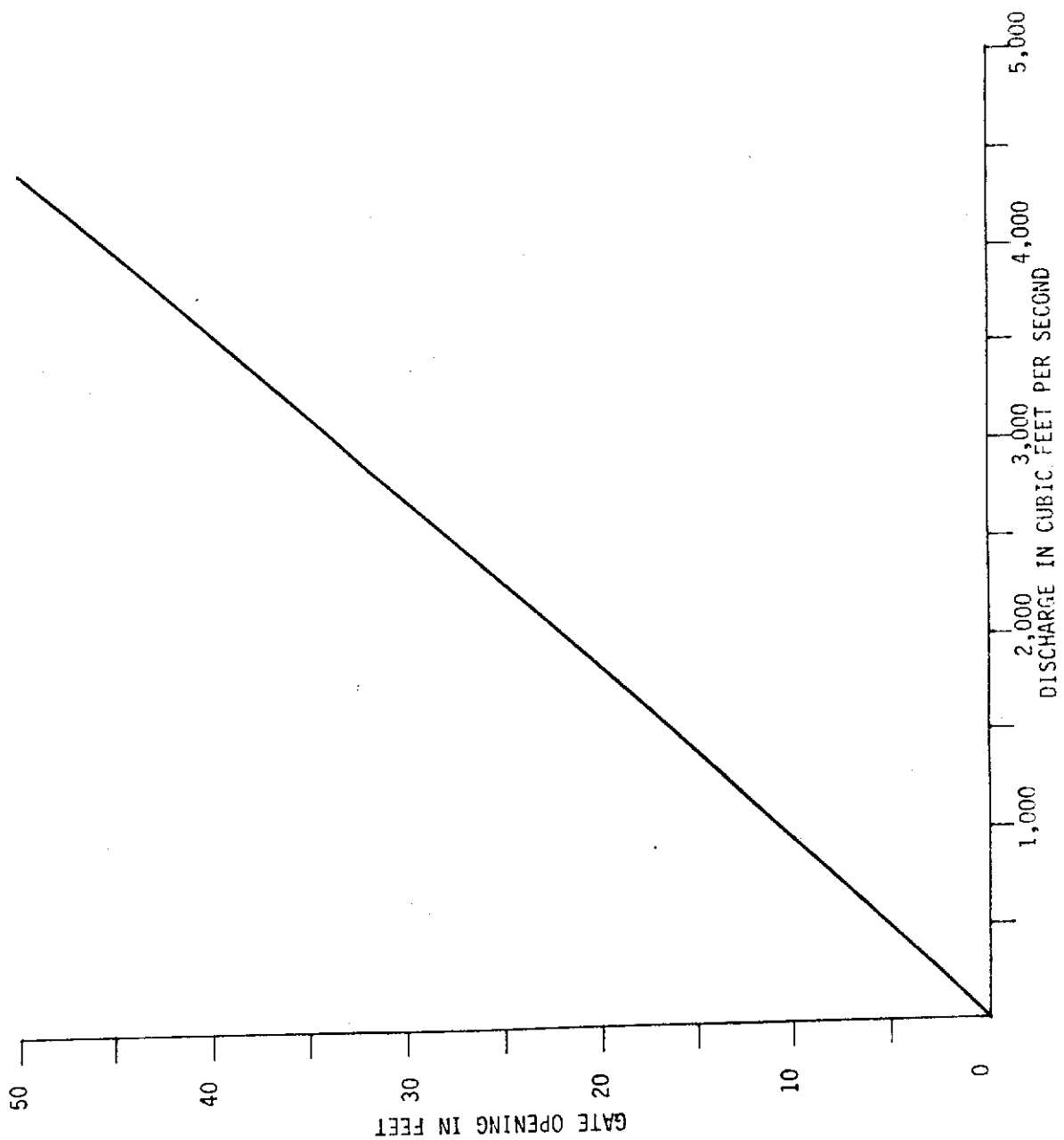


FIG. 28 U.S.G.S. Rating Curve for Hurricane Gates 3, 4, and 5

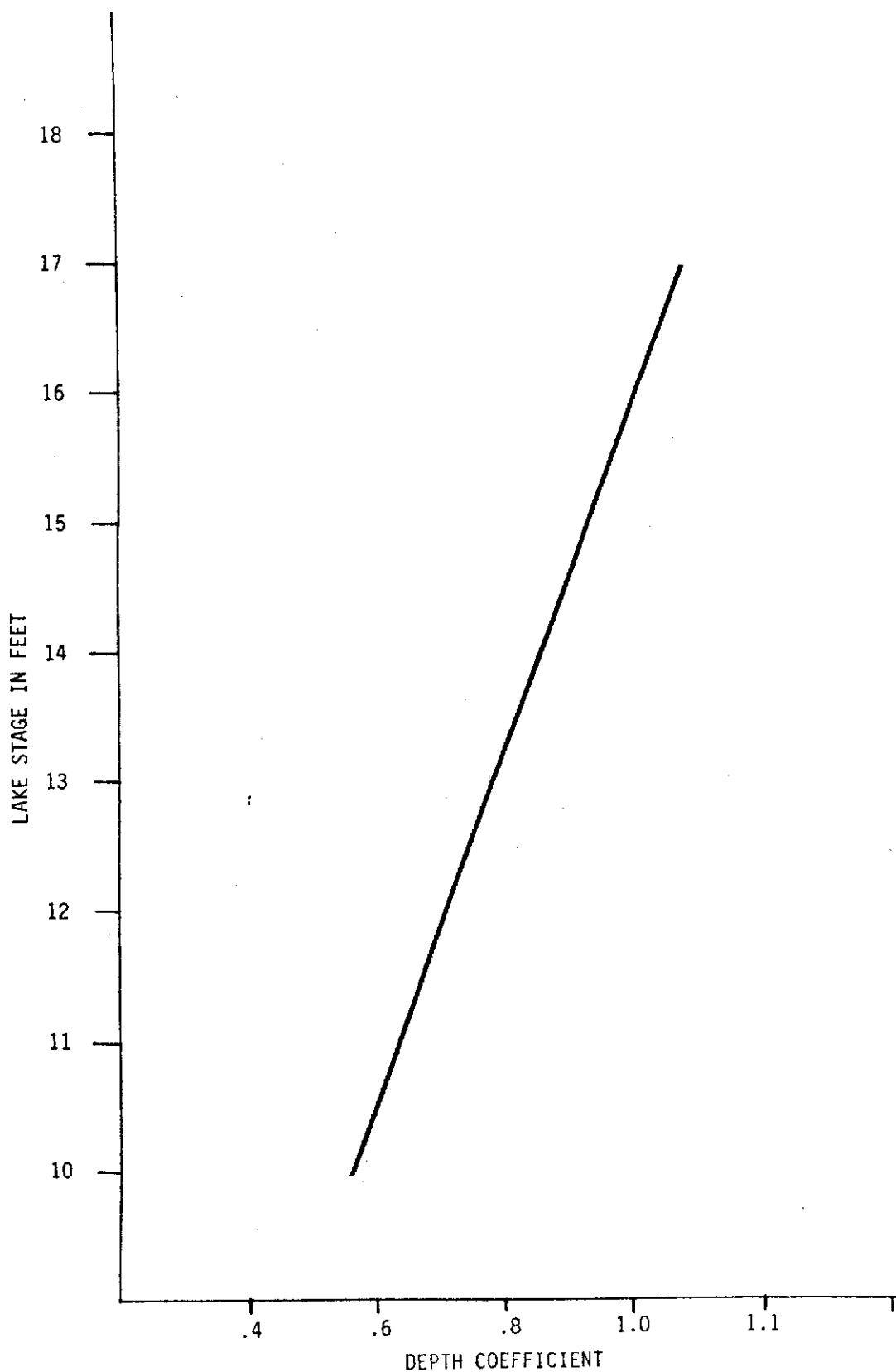


FIG. 29 Graphical Representation of the Relationship Between Lake Okeechobee Stage and the Value of the Depth Coefficient in the Hurricane Gate Structure Curve

In summary, the tailwater stage can be assumed to be maintained at 12 ft (MSL) if the lake stage is above 12.5 ft (MSL). When the lake stage falls below 12.5 ft (MSL), the canal stage is assumed to fall at the same rate as the lake until the lake stage reaches 11.5 ft (at this point the canal will be at 11 ft MSL). When the lake stage falls below 11.5 ft (MSL) the Hurricane Gate 5 tailwater stage is assumed to be maintained at 11 ft (MSL). Once the lake stage falls below 11 ft (MSL), discharge capacity to WCA-1 via the West Palm Beach Canal is assumed to be zero. Figure 30 illustrates the discharge capacity curve for delivering water from Lake Okeechobee to WCA-1 via the West Palm Beach Canal with the assumptions incorporated presented in this section.

2. Water Conservation Area 1

During wet periods along the Lower East Coast the major canals in these regions may be needed for local storm drainage; therefore, allowable releases to all the Lower East Coast service areas from the Water Conservation Areas are calculated as a function of rainfall conditions in the service areas. The discharge capacities calculated from the rating curves for the structures that release water to the service areas are reduced linearly to zero as rainfall increases to .25 inch in a day. When rainfall exceeds .25 inch in a day along the Lower East Coast, no regulatory discharges are allowed from the Water Conservation Areas through these regions regardless of the discharge capacity calculated by the structure rating curves.

It should also be noted that tailwater stages for the structures which release water eastward from the Water Conservation Areas were chosen only for the purpose of estimating flow capacities through these structures. They are not related to actual flood criteria in these canal basins. In fact, the higher the tailwater stages are assumed to be, the less the computed flow capacity will be through the structures to the service areas, thereby giving more flood protection to the individual canal basins.

Major discharges from WCA-1 are made to the east through the Hillsboro and West Palm Beach Canals, and to the southwest through S-10 into WCA-2A. The flow capacity through the West Palm Beach Canal is limited by S-5AE. Normal headwater and tailwater stages maintained at S-5AE allow 700 cfs to pass through this structure under present operational criteria. Therefore this conveyance capacity is assumed to be available for regulatory purposes in the model.

The discharge rating curve for S-39 appears in Figure 31. This relationship is represented by the following expression:

$$QS39 = 953 \times (STGH - STGT)^{.523} \quad (27A)$$

where

- STGH - is the average stage in WCA-1 (ft),
- STGT - is the tailwater stage in the Hillsboro Canal (assumed to be 10.5 ft), and
- QS39 - is the discharge capacity of the structure assuming the gates are open full (cfs).

During the study period between 1963 and 1983, the maximum discharges were estimated to be about 1300 cfs. This value was chosen as the maximum allowable discharge through S-39.

S-10 structure flows are calculated as a function of the headwater and tailwater stage at the structure. Headwater stage is estimated from the areal average stage with the use of the following expression which was obtained from regression analysis run on the historical data:

$$S10HD = .16905 \times STGCA1^{1.5} + 5.05 \quad (27B)$$

where

- S10HD - is the headwater stage at S-10, and
- STGCA1 - is the areal average stage in WCA-1 (ft).

The S-10 tailwater stages were determined to be statistically correlated to both areal average stage and the volume of discharge flowing through the structure. Standard error decreased from .57 ft to .31 ft by including the effects of discharge on the tailwater stage in an analysis of historical data. The relationship used to calculate S-10 tailwater stage is as follows:

$$S10TW = .0018991 \times STGCA2^3 + .03824 \times QS10 - .00024174 \times STGCA2^3 \times \log_{10}(QS10) + .465 \times \log_{10}(QS10) - 6.15 \times \log_{10}(STGCA2) + 15.58 \quad (27C)$$

where

- STGCA2 - is the average stage in WCA-2 (ft),
- QS10 - is the discharge through the S-10 structures the previous day (cfs), and
- S10TW - is the estimated S-10 tailwater stage (ft).

Once the tailwater and headwater stages are calculated at the S-10 structures, the maximum allowable gate opening for non-damaging flows is determined for the structures from the existing rating curves. These are illustrated in Figure 32. After the maximum gate opening is estimated, a flow rate

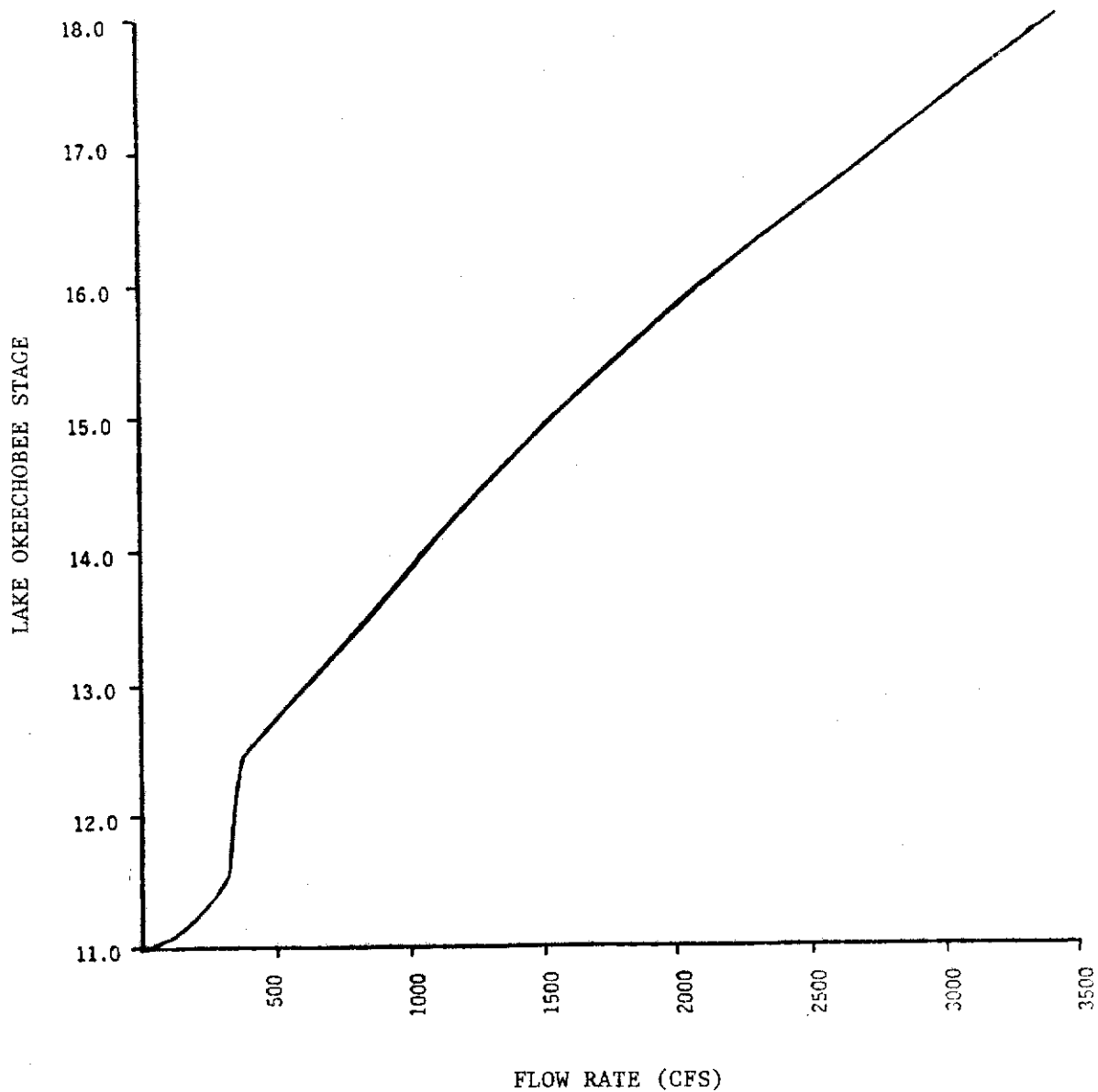


FIG. 30 Rating Curve to Estimate Discharge Capacity from Lake Okeechobee to WCA-1 via the West Palm Beach Canal

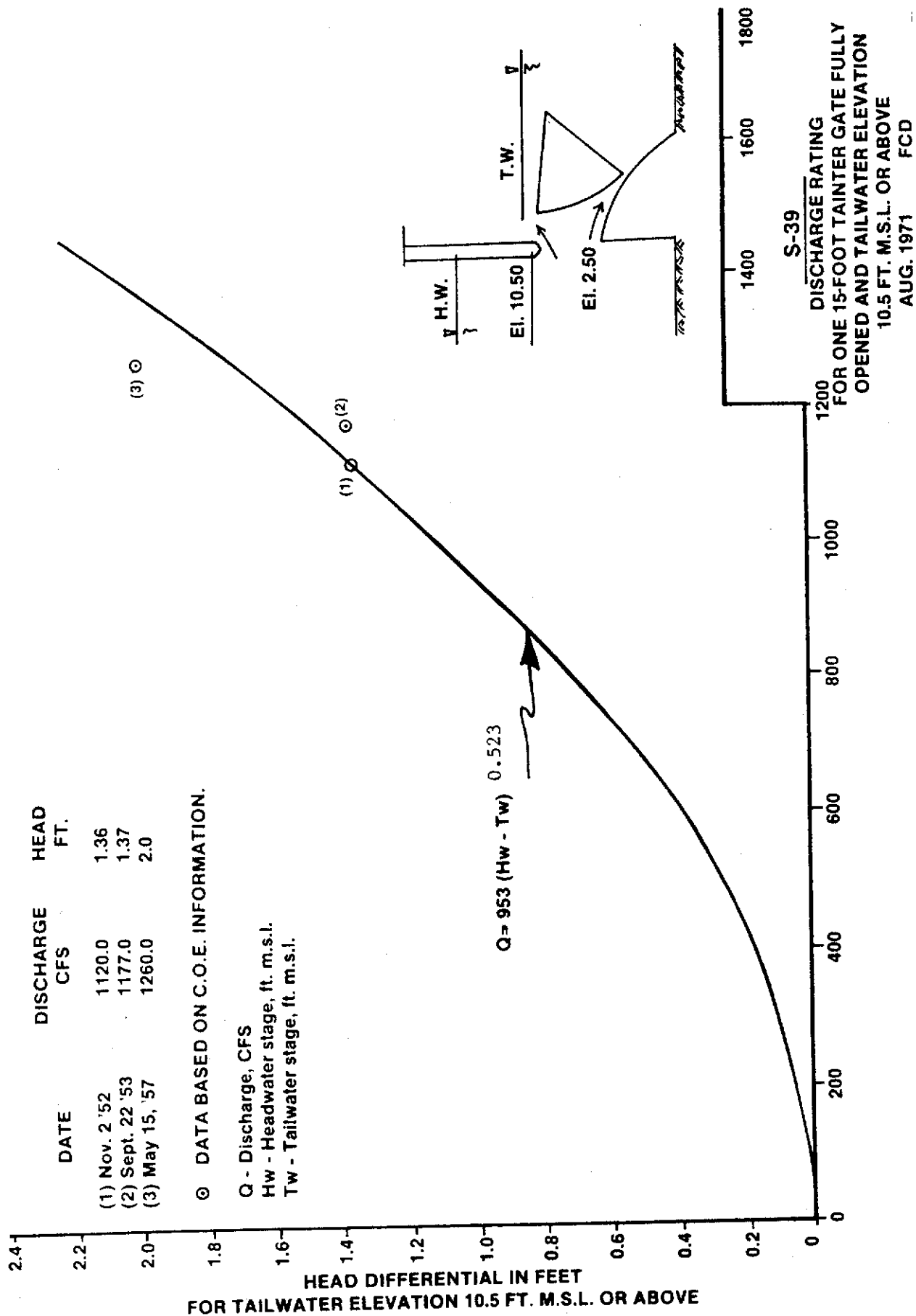


Fig. 31 S-39 Discharge Rating Curve

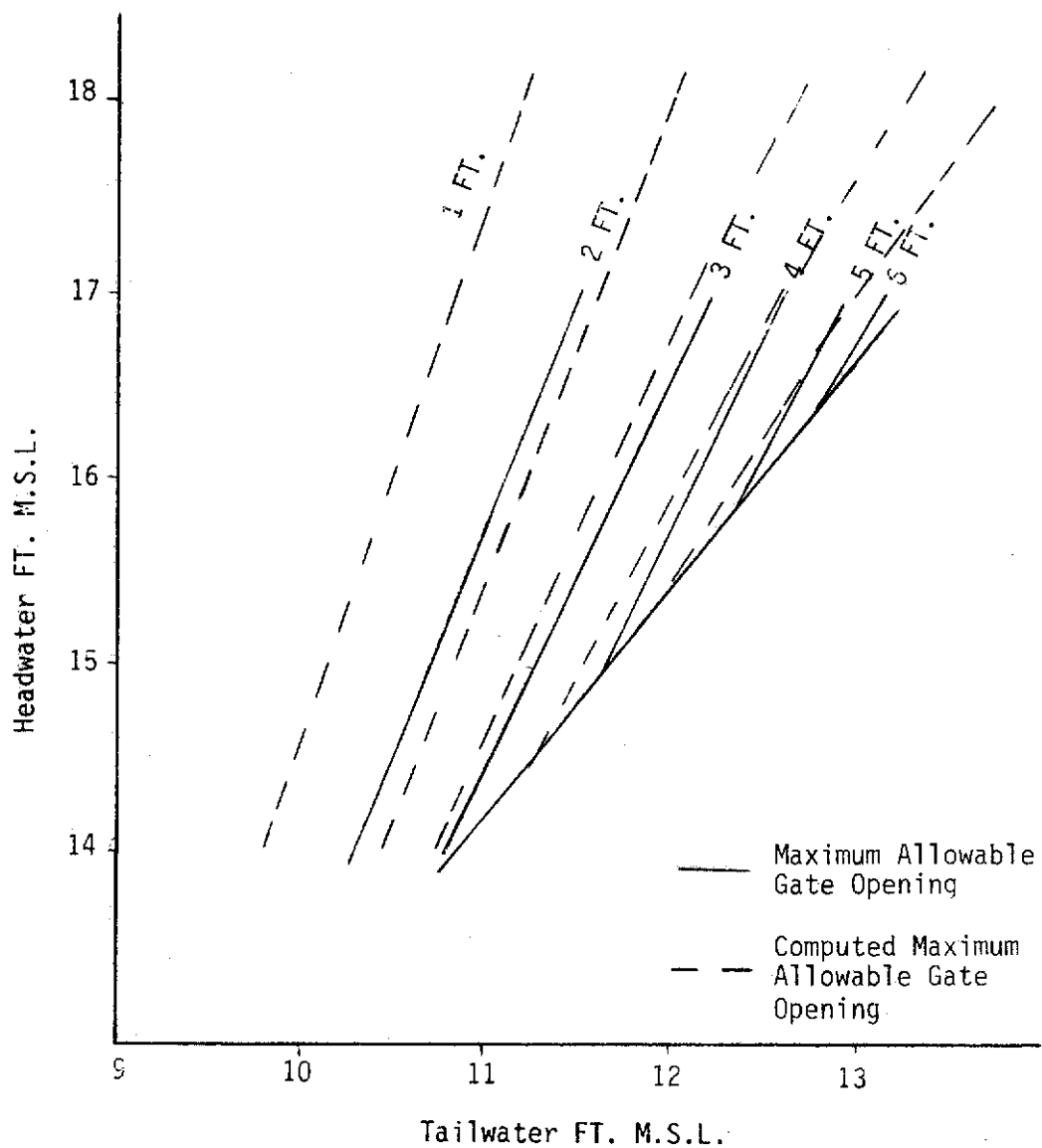


FIG. 32 Maximum Allowable Gate Openings for the S-10 Structures

*General Design Memorandum Part I, Supp. 23, Jan. 1959 ,
File No. 23,246

through the structures can be calculated assuming controlled submerged flow with the aid of the structure discharge relationship in Figure 33. Limitations are included to assure that the modeled gate opening does not clear the modeled water elevation, and that the estimated tailwater stage used for calculating the discharge rate does not fall below the elevation sill and one-half the gate opening of the structure. This assumption will tend to underestimate flows that are not submerged control. However, other types of flows normally exist for relatively short time periods and this will give a conservative estimate of the flow capacity. Using a stepwise regression technique the following expressions were derived to estimate the relationships in Figures 32 and 33. The maximum gate opening is determined by the relationship

$$\text{MGO} = -490.3/\text{S10HD} + 41.25/\text{S10HD}^{1.5} - .00166*\text{S10HD}^3 + .00548*\text{S10TW}^{2.5} + 33.42 \quad (28)$$

where

MGO - is maximum allowable gate opening (ft),
S10HD - is S-10 headwater stage (ft), and
S10TW - is S-10 tailwater stage (ft),

while the discharge rate with this gate opening is estimated by the relationship:

$$\text{QS10} = 10 ((\text{LOG}_{10}(\text{Head}) + 5.47*\text{MGO}^{.134}) / 1.96) \quad (29)$$

where

QS10 - is the maximum discharge rate through the structure (cfs),
Head - is the difference between headwater and tailwater stage across the structure (ft), and
MGO - is the maximum allowable gate opening (ft).

3. Water Conservation Area 2A

Discharges from WCA-2A can be made through S-38 and S-34 to tidal water and through the S-11 structures into WCA-3A. Other small releases are also made to WCA-2B. Figures 34 and 35 graphically present the maximum discharges for S-34 and S-38 respectively. Both structures are assumed to be open full. Average tailwater is assumed to be 10 ft at S-38 and 8 ft at S-34. The expression used to estimate maximum flow capacity for S-34 is:

$$\text{QS34} = 147.44*\text{SQRT}(\text{HDS34} - \text{TWS34}) \quad (30)$$

where

QS34 - is the maximum structure capacity (cfs),
HDS34 - is the headwater estimated at the structure (ft), and

TWS34 - is the tailwater stage at the structure (assumed to be 8 ft).

The expression used for estimating maximum flow capacity at S-38 is:

$$\text{QS38} = 151*\text{SQRT}(\text{HDS38} - \text{TWS38}) \quad (31)$$

where

QS38 - is the maximum flow capacity at S-38 (cfs),
HDS38 - is the estimated headwater stage at S-38 (ft), and
TWS38 - is the estimated tailwater stage at S-38 (assumed to be 10 ft).

The S-11 structures limitations are similar to the S-10 structures on the maximum allowable gate openings. These gate openings are a function of headwater and tailwater stages as illustrated in Figure 36. The S-34, S-38, and S-11 gate openings are limited so that the modeled opening does not clear the estimated water level and that the tailwater stage does not fall below the elevation sill, or one-half the gate opening. They are approximated in the model by the following expression:

$$\text{MGS11} = .04327*\text{TW}^2 + 8.55*\text{EXP}(-\text{HD}-\text{TW}) + 1.557*\text{LOG}_{10}(\text{HD}-\text{TW}) - 3.95 \quad (32A)$$

where

MGS11 - is the maximum allowable gate opening (ft),
HD - is the headwater stage at the S-11 structures (ft), and
TW - is the tailwater stage at the structures (ft).

The headwater and tailwater stages were found to be statistically correlated with WCA-2A and WCA-3A average stages, and with the previous day discharges through the structures. The expressions used to estimate the headwater and tailwater stages are as follows:

$$\text{HDS11} = 1.0196*\text{AVG2A} - .00036867 * \text{QS11} - .51 \quad (32B)$$

where

HDS11 - is the S11 headwater stage (ft),
AVG2A - is the average stage in WCA-2A (ft), and
QS11 - is the previous day's discharge through S-11 structures (cfs).

and

$$\text{TWS11} = 7.203 * \text{SQRT}(\text{STG}) + .00017356*\text{QS11} - 12.679 \quad (32C)$$

where

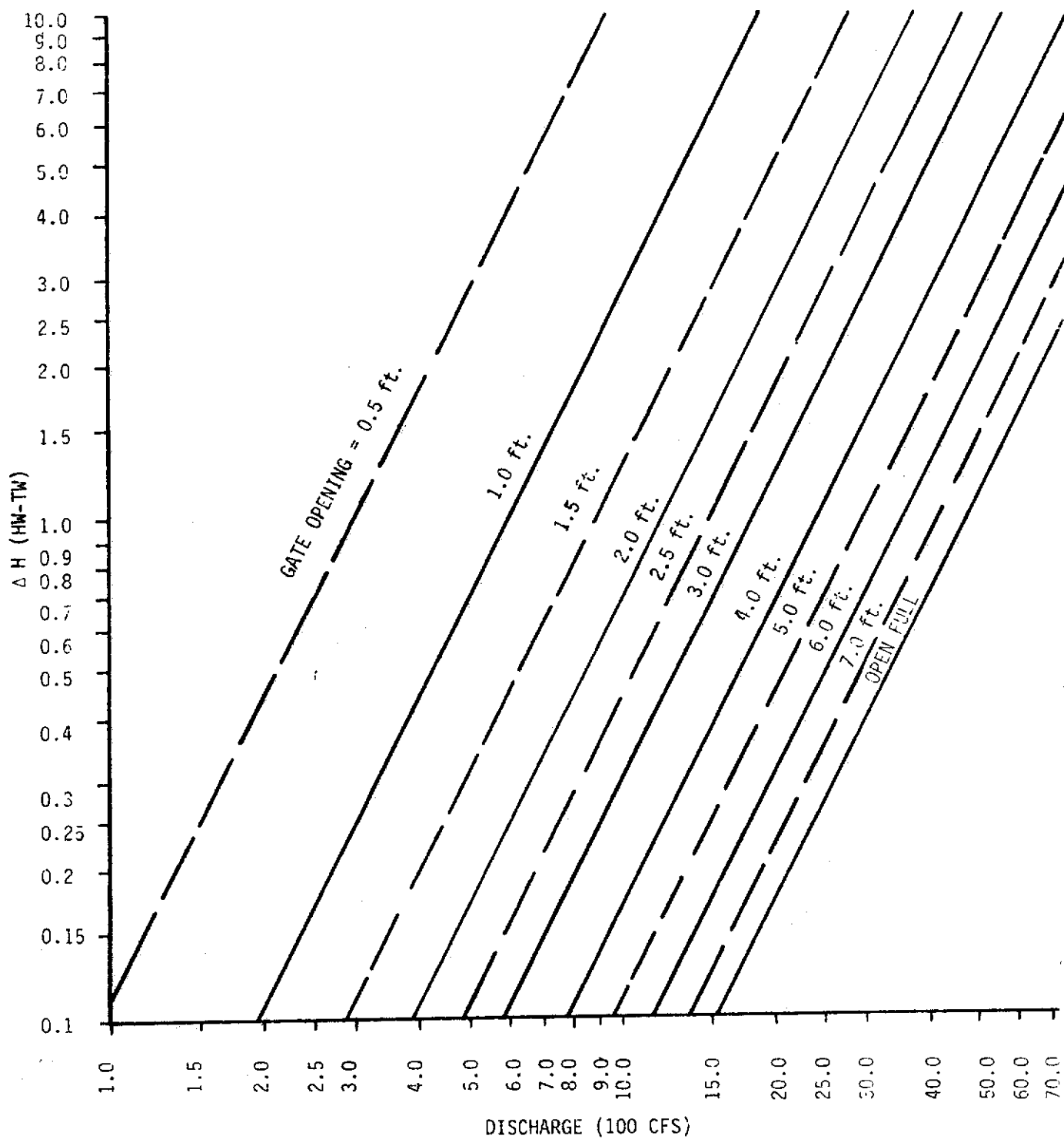


FIG. 33 Discharge Rating Curve for the S-10 Structures
 *WMD Structure Book

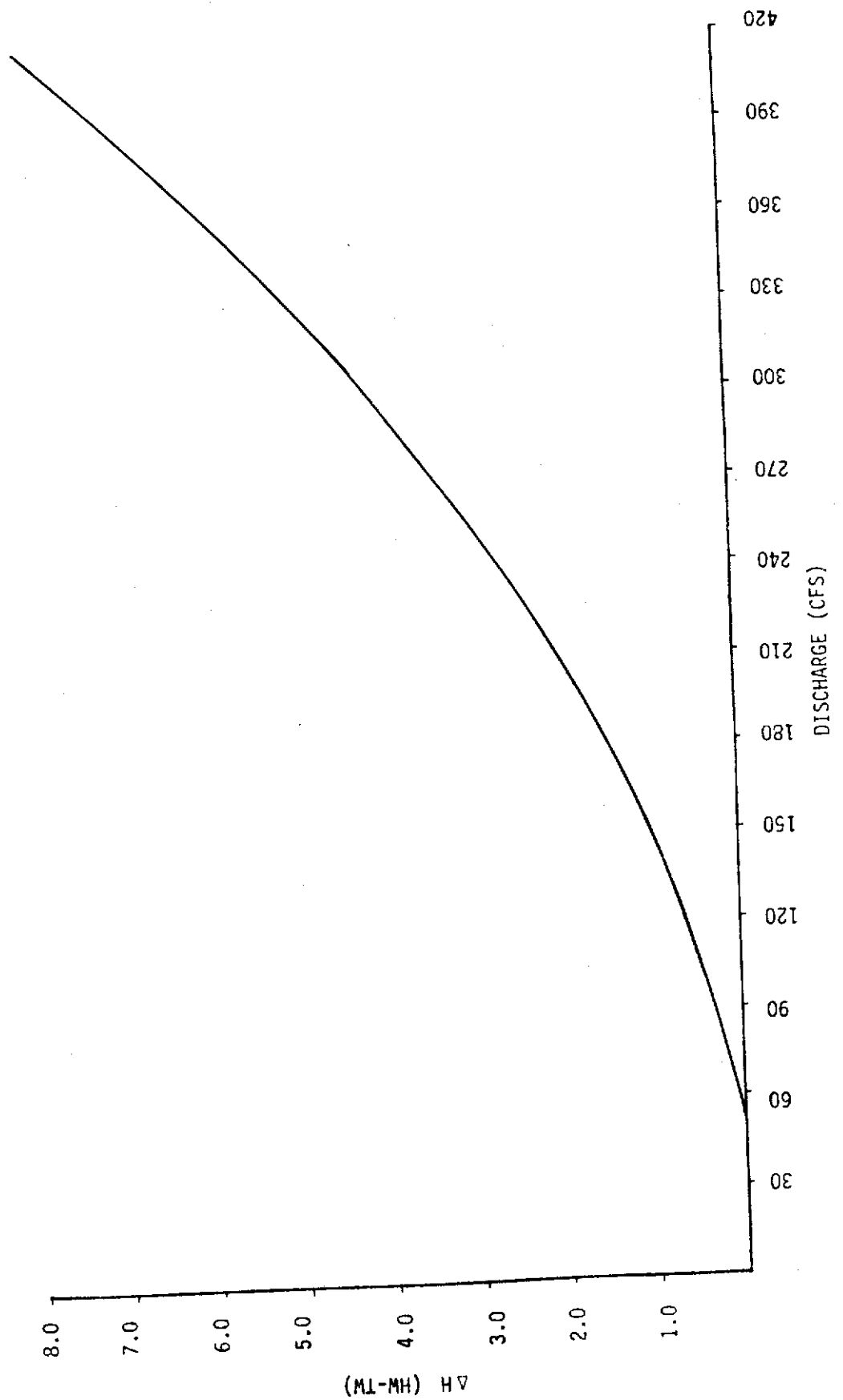


FIG.34 Discharge Rating Curve for the S-34 Structures

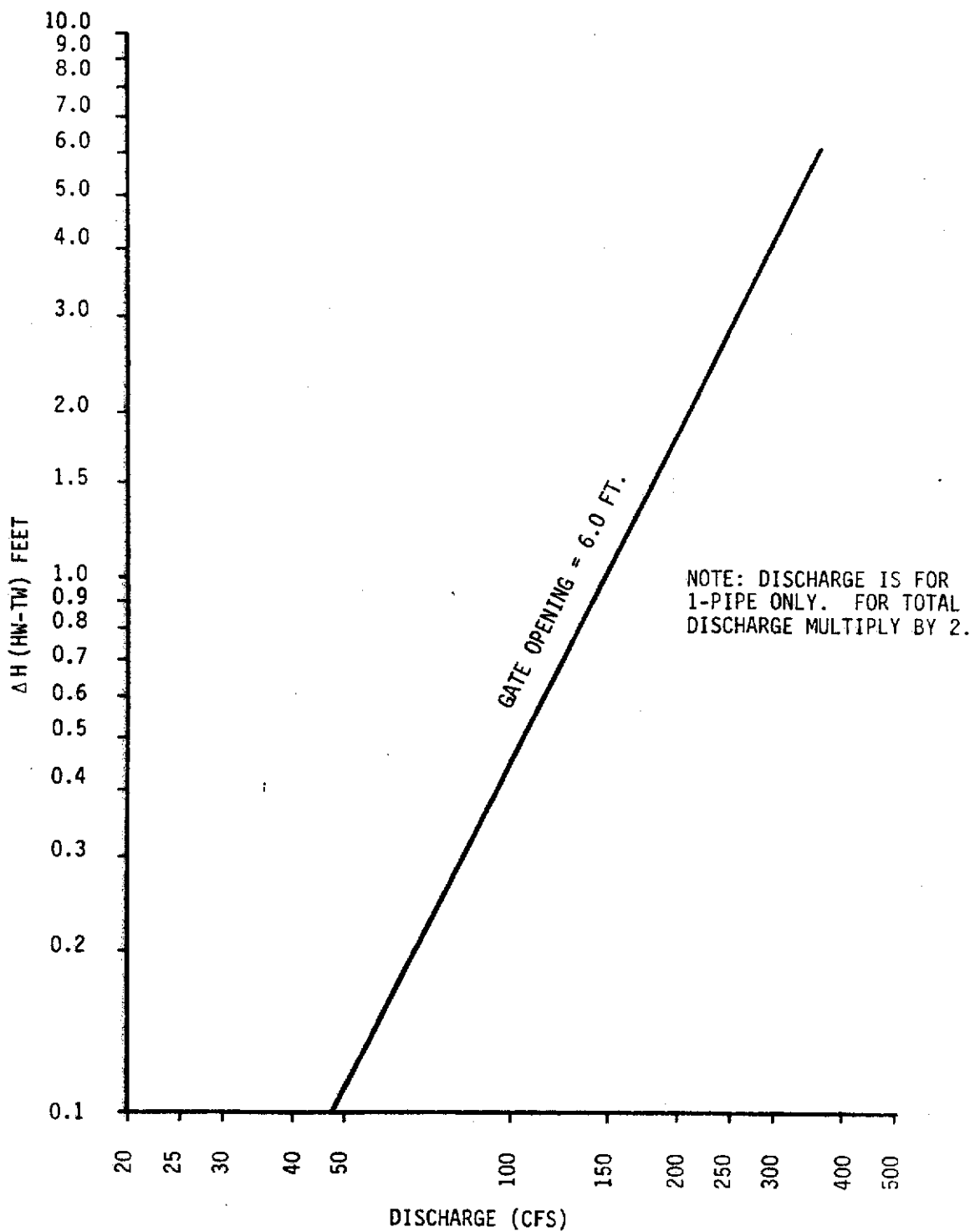


FIG. 35 Discharge Rating Curve for the S-38 Structures
*WMD Structure Book

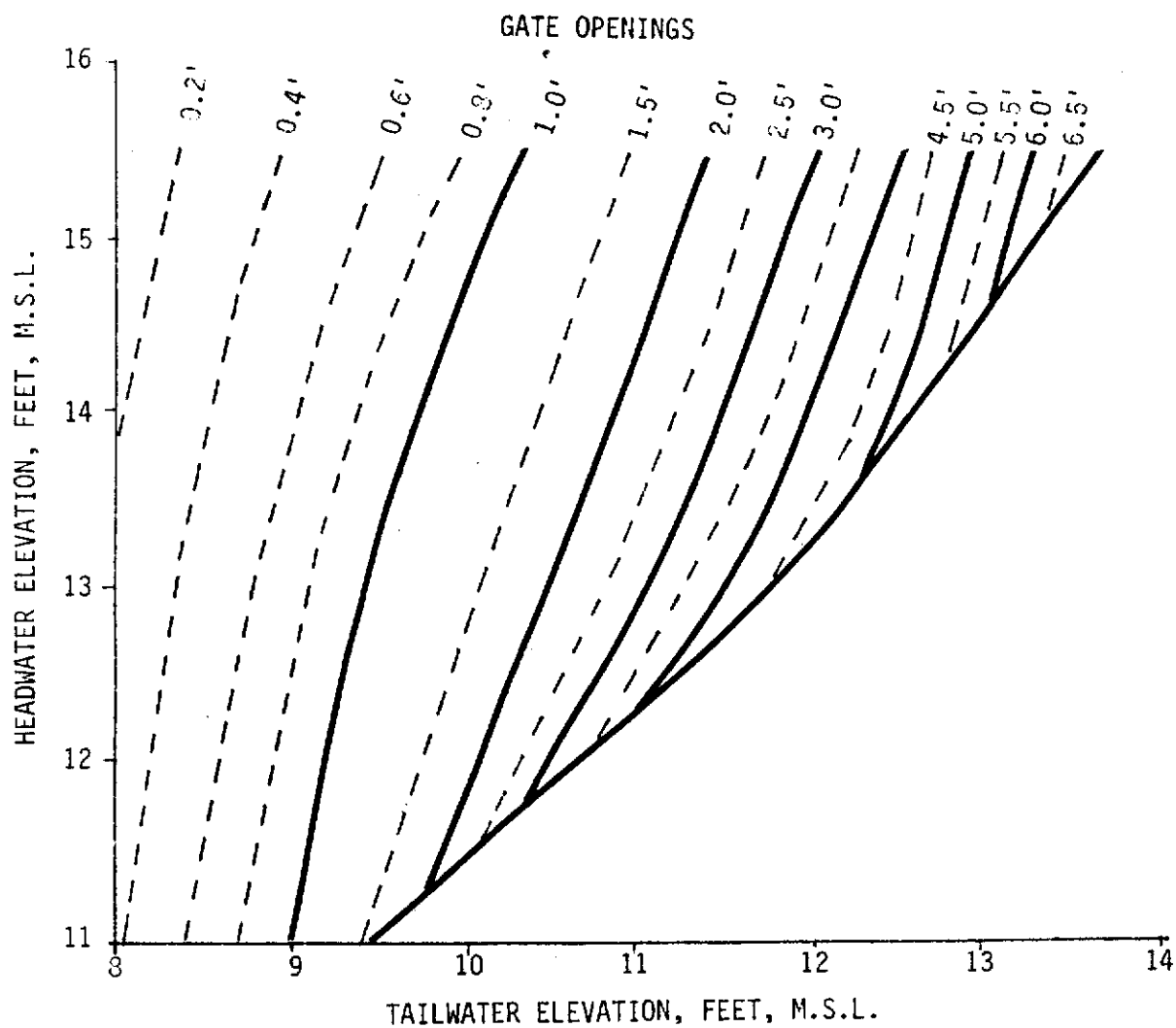


Fig. 36 Maximum Allowable Gate Openings for the S-11 Structures

*WMD Structure Book

TWS11 - is the tailwater stage at the S-11 structures (ft),
 AVG3A - is the average stage in WCA-3A (ft),
 and
 QS11 - is again the previous day's discharge through S-11 (cfs).

As illustrated in Figure 36, limitations on gate opening can be quite stringent for one set of headwater and tailwater conditions; but with only a slight change in headwater or tailwater conditions, limitations may not be required. In the model, two linear relationships are used to determine if gate openings are required. When headwater is less than 12.1 ft., the relationship used is:

$$\text{CHDS11} = .8235 * \text{TWS11} + 3.217 \quad (33)$$

where

CHDS11 - is the critical headwater stage in which limitations in gate openings become necessary if headwater stage exceeds this value. The critical headwater stage is obviously a function of tailwater stage (TWS11) at structure S-11.

When the stage is greater than 12.1 ft. (MSL), a similar relationship can be expressed by:

$$\text{CHDS11} = 1.375 * \text{TWS11} - 3.2625 \quad (34)$$

where

CHDS11 and TWS11 are defined the same as Equation 33.

Once the gate opening, tailwater stage, and headwater stage are determined, then Equation 29 may be used to estimate flows through the S-11 structures. The S-11 discharge rating curves are the same as the S-10 rating curves. A possible future improvement to the model may be to include the effects of uncontrolled discharges at the S-11 structures for certain hydrologic conditions.

4. Water Conservation Area 3A

Water Conservation Area 3A's major discharges are made through S-151 into WCA-3B, through the S-12 structures to Everglades National Park, through S-333 to the Tamiami Canal, and through the S-343A and S-343B culverts. The structure rating curve for S-151 appears in Figure 37. This rating curve is represented by the expression:

$$\text{QS151} = 700 * \text{SQRT}(\text{HD151} - \text{TWS151}) \quad (35)$$

where

QS151 - is the discharge through the structure (cfs),
 HD151 - is the headwater stage (ft) in WCA-3A,

and
 TWS151 - is the tailwater stage (ft msl) in WCA-3B.

Historical WCA-3A average stages versus S-12 historical discharges appear in Figure 38. The line chosen to represent this data can be expressed by the equation:

$$\text{QS12} = (.08540 * (\text{AVG3A})^3 - 27.73558)^2 / 1.983 \quad (36)$$

where

AVG3A - is WCA-3A average stage (ft), and
 QS12 - is the S-12 discharge capacity (cfs).

Preliminary data with the L-67 EXT plug in place indicates that discharges may be reduced another 10-15%. The base run includes the effects of the plug being in place with the S-12 structures open full by multiplying Equation 36 by a reduction coefficient. The S-333 discharges are limited by downstream canal capacity; however modeling the tailwater conditions is presently beyond the scope of this model. The S-333 discharges in the model are estimated as a function of WCA-3A stages. S-333 is assumed to be able to pass 1000 CFS above 9.5 ft (MSL). The capacity is assumed to linearly decrease to 200 cfs as the stage falls to 8 ft (MSL). The discharge capacity below 8 ft is assumed to linearly decrease to 0 cfs at 6.5 MSL.

S-343A and S-343B culverts are assumed to have a discharge capacity of 165 cfs.

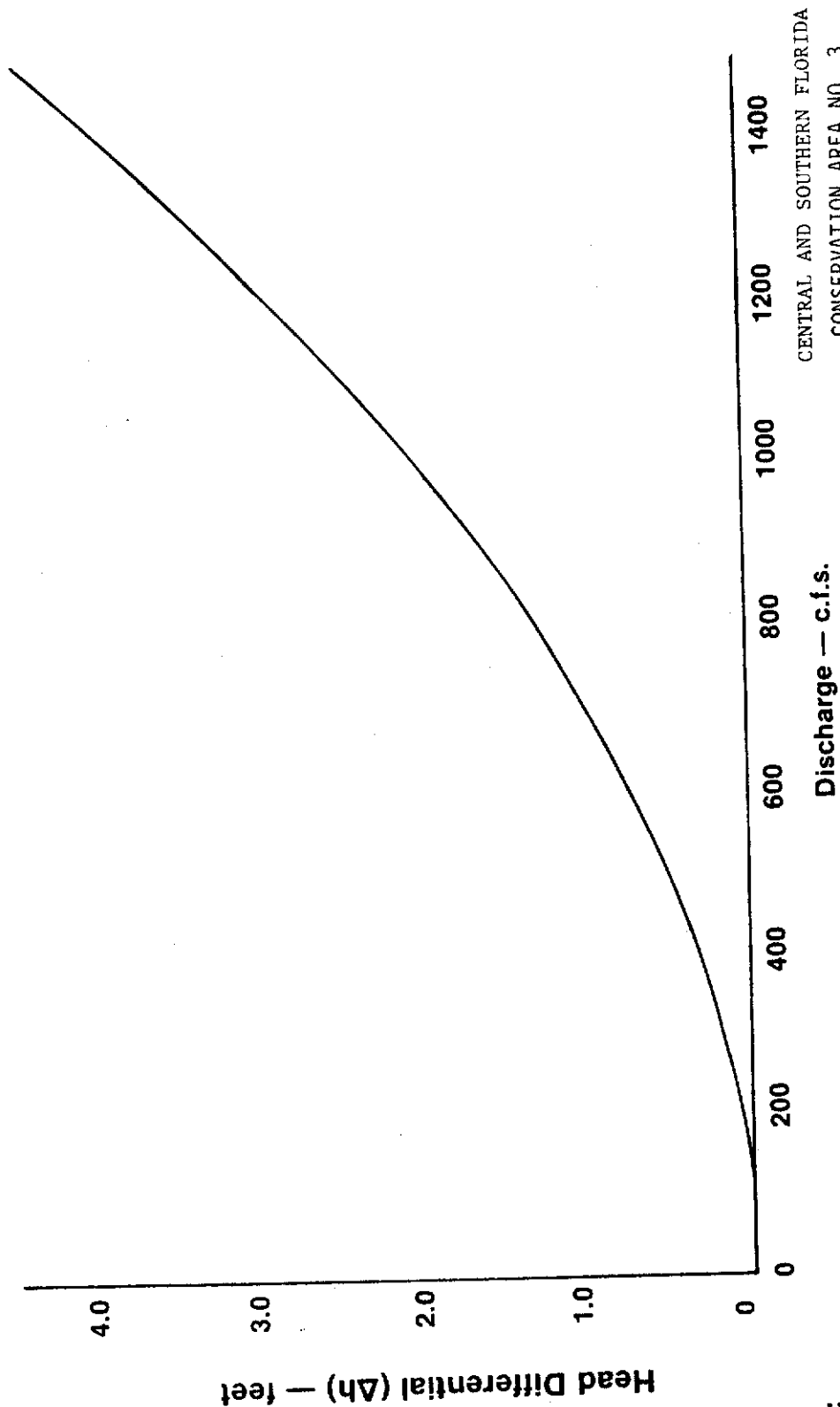
5. Water Conservation Area 2B

Presently, this Water Conservation Area is assumed to act exactly as it did historically. Therefore, all inflows and outflows will be assumed to be the same and the daily change in storage will be the same as it was historically, except for changes in seepage rates between regions due to the drawdown schedule being in effect in WCA-2A.

6. Water Conservation Area 3B

Water Conservation Area 3B has two outlets. The first is S-31 which discharges water eastward to the Miami Canal, while S-337 releases water southward to the South Dade Conveyance System.

The culvert structures located at S-31 are the same design as those located at S-151, however, there are half as many culverts so that the rating curve for S-31 is one-half that for S-151. Tailwater at the S-31 structure is assumed to be 3.0 ft. Capacity south through S-337 is assumed to be 800 cfs.



NOTES:

1. STRUCTURES ARE TWIN 6.0x9.4 FT. CONCRETE BOX CULVERTS.
2. DISCHARGE CURVE IS FOR CULVERTS FLOWING FULL, WITH THE TAILWATER AT OR ABOVE THE CROWN OF THE STRUCTURE, AND ALL GATES FULLY OPEN.

CENTRAL AND SOUTHERN FLORIDA
 CONSERVATION AREA NO. 3
 STRUCTURES 151 and 31
 DISCHARGE CURVE
 GENERAL DESIGN MEMO
 PART I, SUPP 33

Fig. 37 Discharge Rating Curve S-151

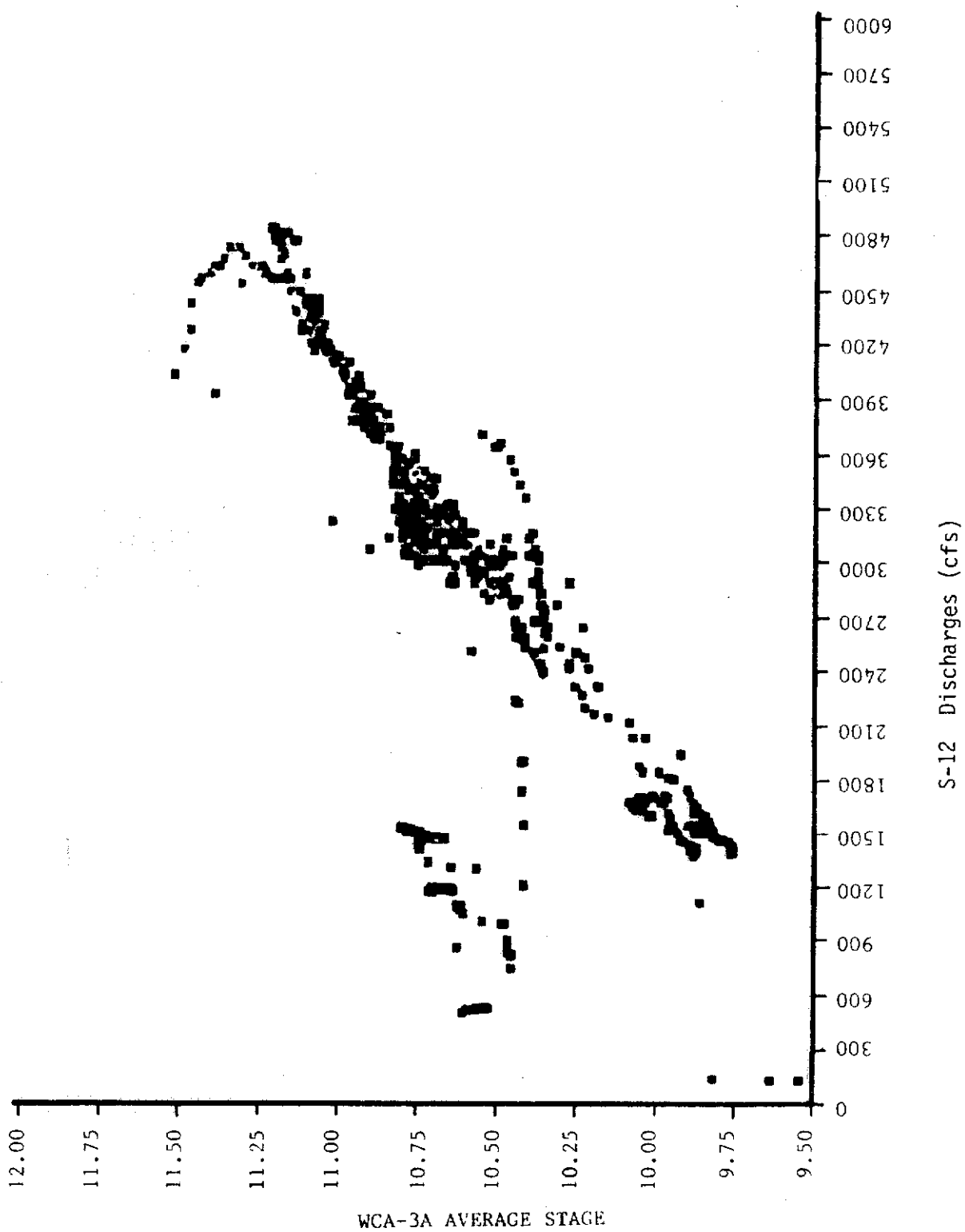


FIG. 38 S-12 Discharges versus WCA-3A Stages

V. VERIFICATION

The normal calibration and verification procedures concerning the functional representation of seepage and evapotranspiration is not applicable to this model. By definition, the historical stage and the calculated stage will be equal when historical discharges are imposed. Therefore, the majority of the modeler's effort may be spent incorporating the correct management schemes that will best represent the operational policies of Lake Okeechobee and the Water Conservation Areas.

The purpose of this section is to illustrate the ability of the model to simulate various management policies. This is accomplished by comparing the calculated discharges and stages with those that occurred during a historical period. Since operational policies and water use requirements have been frequently altered over recent years, specific periods of record must be chosen to verify that specific operational policies are incorporated properly. Even when limiting the calibration periods to relatively short periods, special concerns may arise so that operation of the system may vary from that imposed in the model. The model still was able to simulate historical stages reasonably well.

The comparison between historical stages and those calculated between 1981 and 1983 for Lake Okeechobee and Water Conservation 3A appear in Figures 39a and 39b. Monthly simulated discharges through the S-80 structure are plotted against historical discharges through these structures as another example of a type of output that is available with the model. This comparison appears in Figure 39c.

VI. ANALYSIS OF THE BASE RUN RESULTS

The base run simulates stages and discharges assuming that present day (1986) operative criteria and conveyance limitations are in effect, and that specific historical weather conditions will reoccur. Since different operational policies and conveyance limitations were in effect during historical periods, it is not expected that discharge rates or stages would simulate the historical hydrological values. It is expected that during the more recent period the model will simulate historical conditions closer, since the present physical system is very similar to that being modeled. However, operational policies have changed over this period - changes which include the incorporation of the WCA-2A drawdown schedule, a greater percentage of the runoff from the Everglades Agricultural Area being routed to the Water Conservation

Areas, and the experimental releases of water to Everglades National Park and to the St. Lucie Estuary. Graphical presentation of the comparison between historical stages and base run stages for Lake Okeechobee appear in Appendix 1.

A. Lake Okeechobee

During the last six years Lake Okeechobee stages have matched historical stages fairly close. This occurred even with the difference in some of the operational policies incorporated into the model. The lake was slightly lower during 1981-1982 due to increased demands from the South Dade Conveyance System. Prior to 1977 (before the construction of S-308), model results indicated that stages would be higher during the wet periods due to lower regulatory releases; however, due to larger water use requirements during dry periods, lake stages may be lower than historically (see 1971-1974). The hydrologic 1971 drought would not have been so severe with the present system in effect because of the greater storage capabilities of the present system.

B. Water Conservation Area 1

WCA-1 tends to dry out much more often than historically because of the incorporation of the 14-17 ft regulation schedule. In actual practice, the regulation schedule for WCA-1 includes the option of whether to lower WCA-1 to 14 ft or 15 ft.

C. Water Conservation Area 2A

WCA-2A water levels are much lower under the present drawdown schedule than those that actually occurred historically. The WCA-2A historical stage is estimated at the 2-17 gage. Land elevation at the gage location is about 11 ft above mean sea level; therefore, the gage does not give a good representation of the available surface water storage in WCA-2A when the average stage falls below 11 ft.

D. Water Conservation Area 3A

The present experimental operational policies for deliveries to Everglades National Park are described in Section IV.B. The purpose of this plan is to return flow patterns back to their more natural condition; therefore, temporal distribution of discharges to the park are calculated as a function of rainfall distribution in WCA-3A. This plan is also beneficial for water supply within WCA-3A. Historical releases to Everglades National Park were made based on a minimum monthly release schedule for the periods that WCA-3A was below schedule, and maximum discharges for the period when it was above schedule.

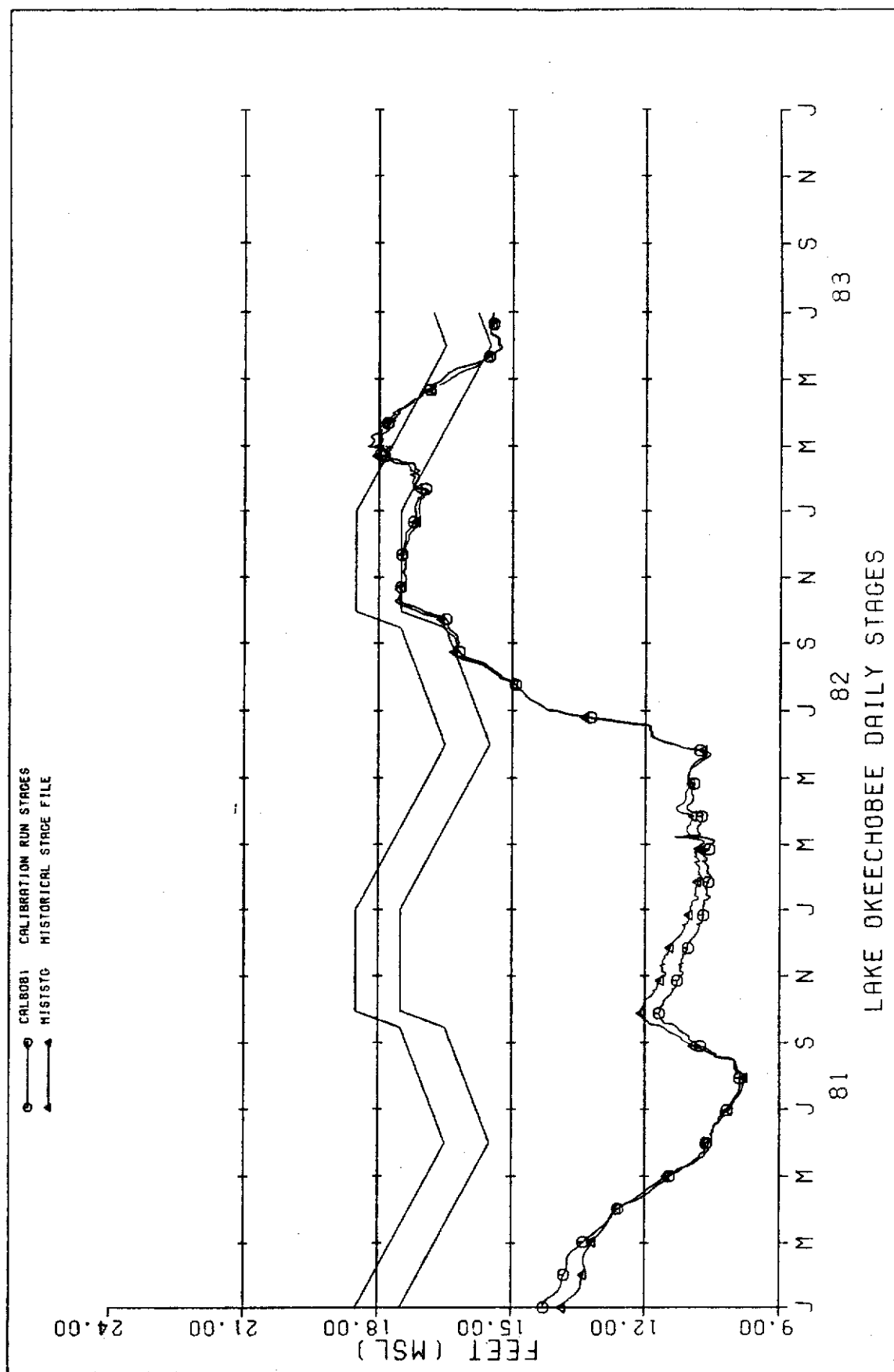


Fig. 39a COMPARISION CALIBRATION VS. HISTORICAL

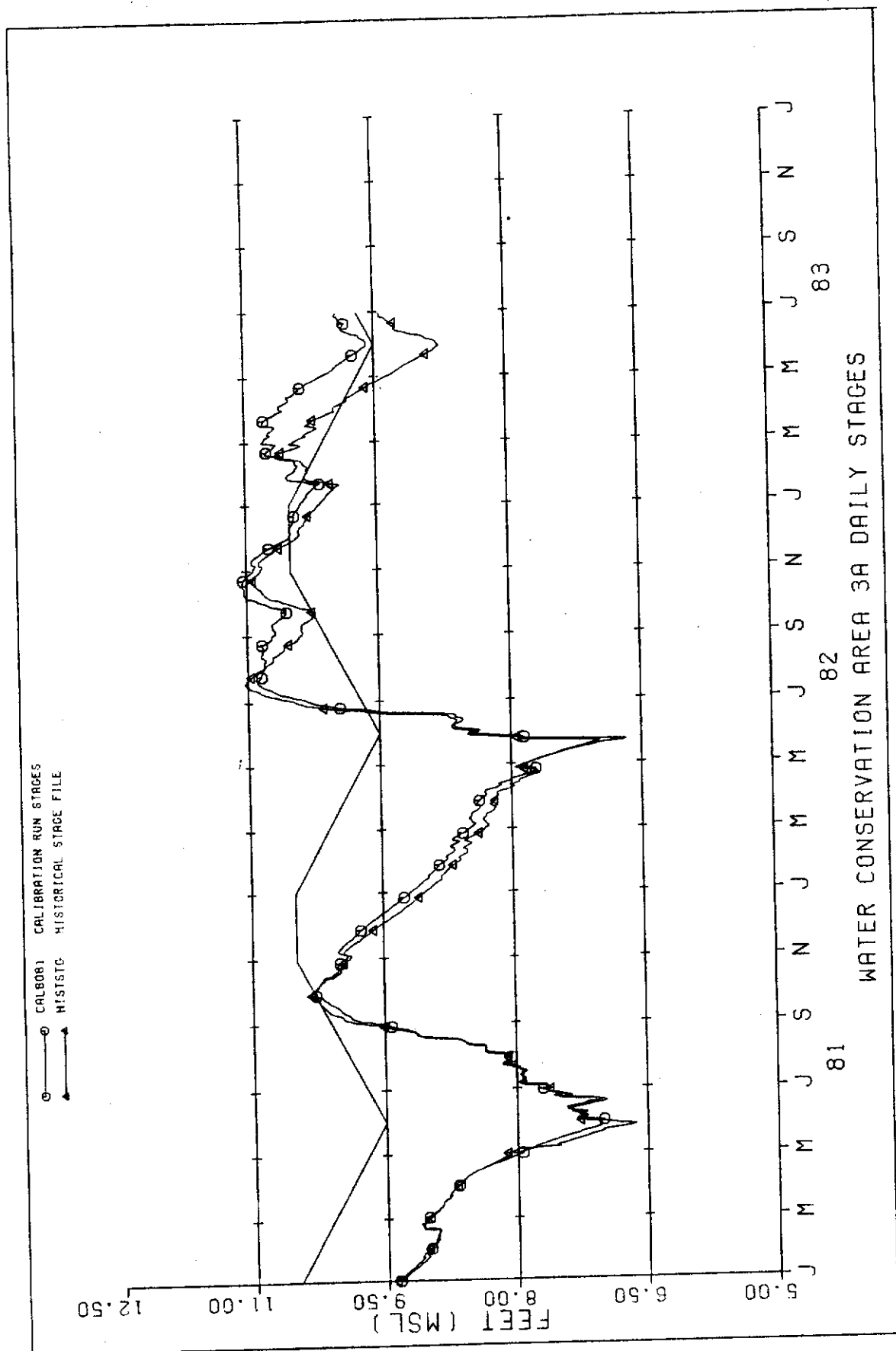


Fig. 39b COMPARISON CALIBRATION VS. HISTORICAL

S-80 Monthly Discharges

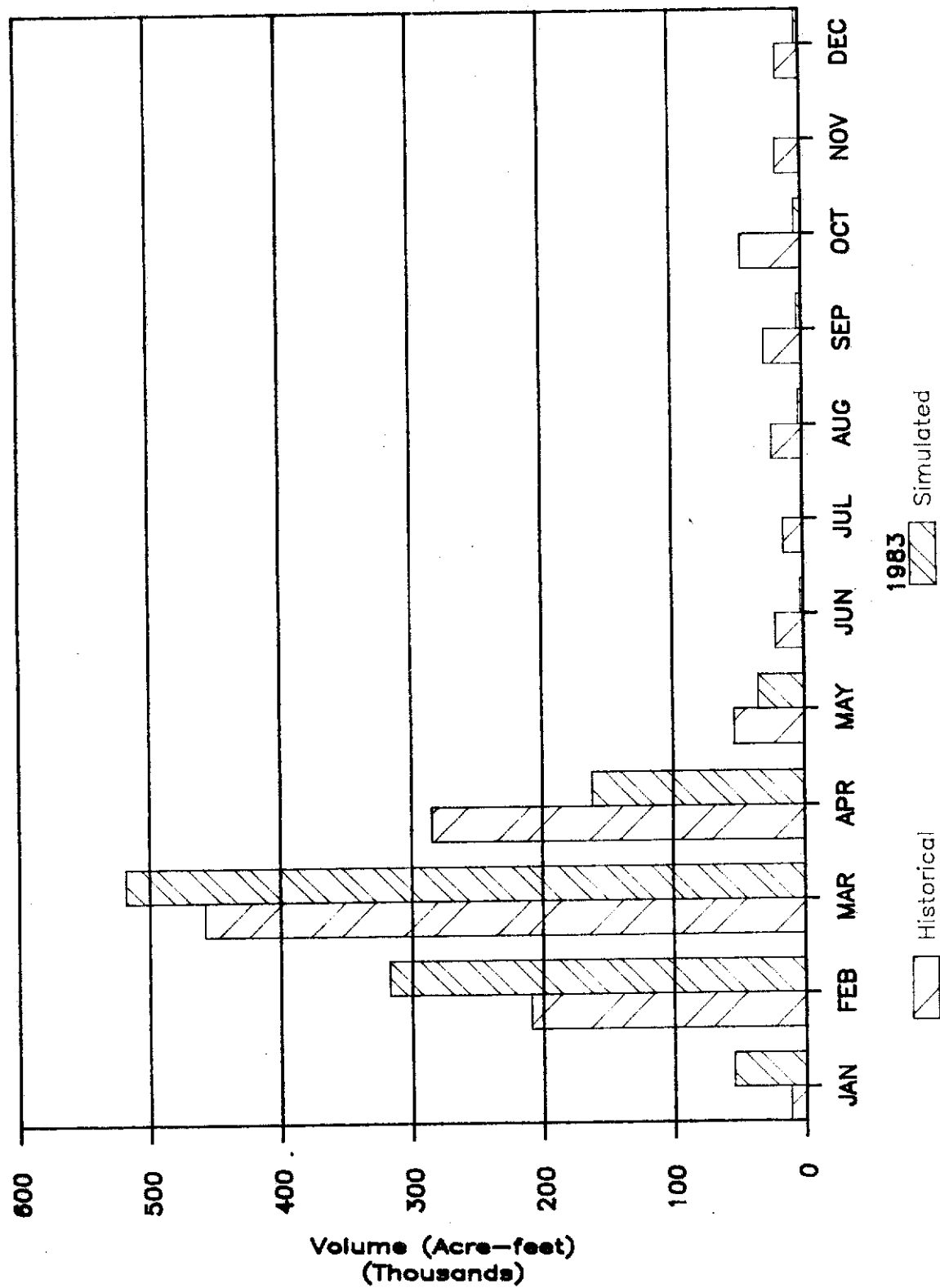


Fig. 39c S-80 Monthly Discharges

The historical policy created the potential for sudden large discharges that occur even for near normal rainfall conditions.

VII. MODEL APPLICATION

This model may be used for evaluating regulation schedules, water use cutback policies, the effects of future increased water use requirements, or for studying the quantitative effects of backpumping stormwater into a particular reservoir. Other options available enable the user to study the effects of increasing the conveyance capacity between regions, interconnecting new drainage basins to the Water Conservation Areas, or the effects of the occurrence of severe storms with different regulation schedules imposed. The uses of this model are illustrated in the following subsections.

A. Illustration of the Effects of Altering the Lake Okeechobee Regulation Schedule

Assuming that rainfall conditions will be the same as those that had occurred during the 1963-1983 period, the base run projects what stages would occur in Lake Okeechobee, the percentage of water use requirements satisfied, and the amount of regulatory releases required. A summary of these values appears in Figure 40. Figure 41 illustrates a new schedule and summarizes the corresponding stages, water use requirements satisfied, and the number of regulatory releases required with this new schedule put into operation.

The principal advantage of the new schedule is that the number of large Zone A discharges are reduced. These large discharges cause erosion and ecological damage to the estuary; however, the disadvantage to this new schedule occurs due to reduced water use requirements being satisfied.

B. Evaluating Current Water Conditions

This model has the option of being initialized every year on a specific date with the various water conditions. The model user may then determine, if certain water conditions exist on a certain date, what the chances are for regulatory releases or water use cutbacks the following year when different operational policies are incorporated into the model based on the 1963-1983 rainfall conditions. This option may also be used to evaluate current water conditions by initializing the model with the current days water levels to determine the chances for cutbacks and regulatory releases the following year based on the same historical period of record. After

this initialization process is completed for each year, a statistical analysis may be completed to determine stage-frequency curves for future months in each area. Examples of these stage frequency curves appear in Figure 42.

This model has many options available to the user. A Users Guide to these options appears in Appendix 2.

VIII. COMPUTER PROGRAM

A. Sub-Programs

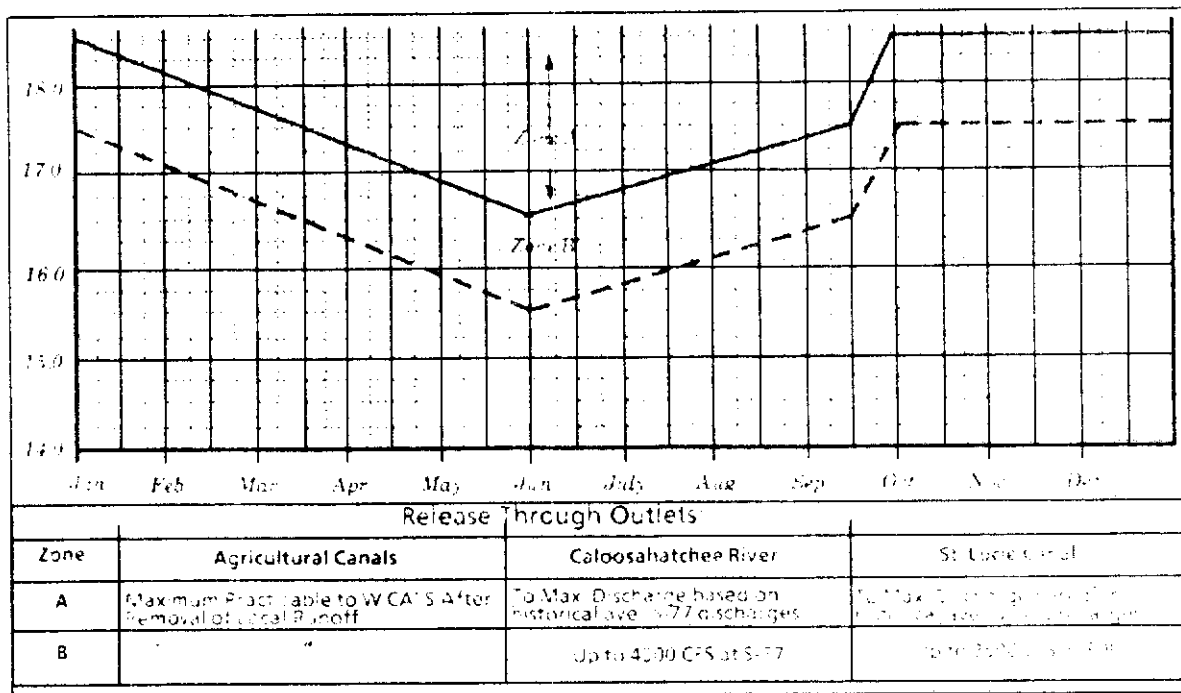
The computer model consists of a main program and ten subroutines or functions. A flow chart of the computer model appears in Figure 43. An explanation of each follows:

1. Subroutine SPWEB is the main program. Its purpose is to determine the computational order of various calculations and procedures executed in the model. It achieves its function by calling specific subroutines in the appropriate time sequence.

2. Subroutine INTDATA is called at the beginning of model execution. Its function is to open input data files and to read into the program time invariant data. Three data files, DDATA, DDEL, and DDMND are opened. DDATA contains the time invariant data that subroutine INTDATA reads. DDEL contains the preprocessed daily change in storage for each water reservoir and the daily regulation schedules. This information is read each day by subroutine STATE. DDMND contains the preprocessed demands of each service area in the model. These are input into subroutine DELIVER each day. The time invariant data read into the model by subroutine INTDATA include:

- a. The first and last year of the particular model run.
- b. Initial values of specific constants.
- c. Minimum storages for each surface water reservoir below which no water may be extracted from the reservoir.
- d. Stage-storage breakpoint curves for each storage area.
- e. Stage-discharge breakpoint curves for the S-10, S-11, and S-12 structures.

3. Subroutine STATE includes the effects of rainfall, ET, seepage, and other predetermined flow rates that are independent of the management options in this model. Preprocessed changes in storage are read by this subroutine and added to each area. Subroutine CTOSTG is called at this time to convert

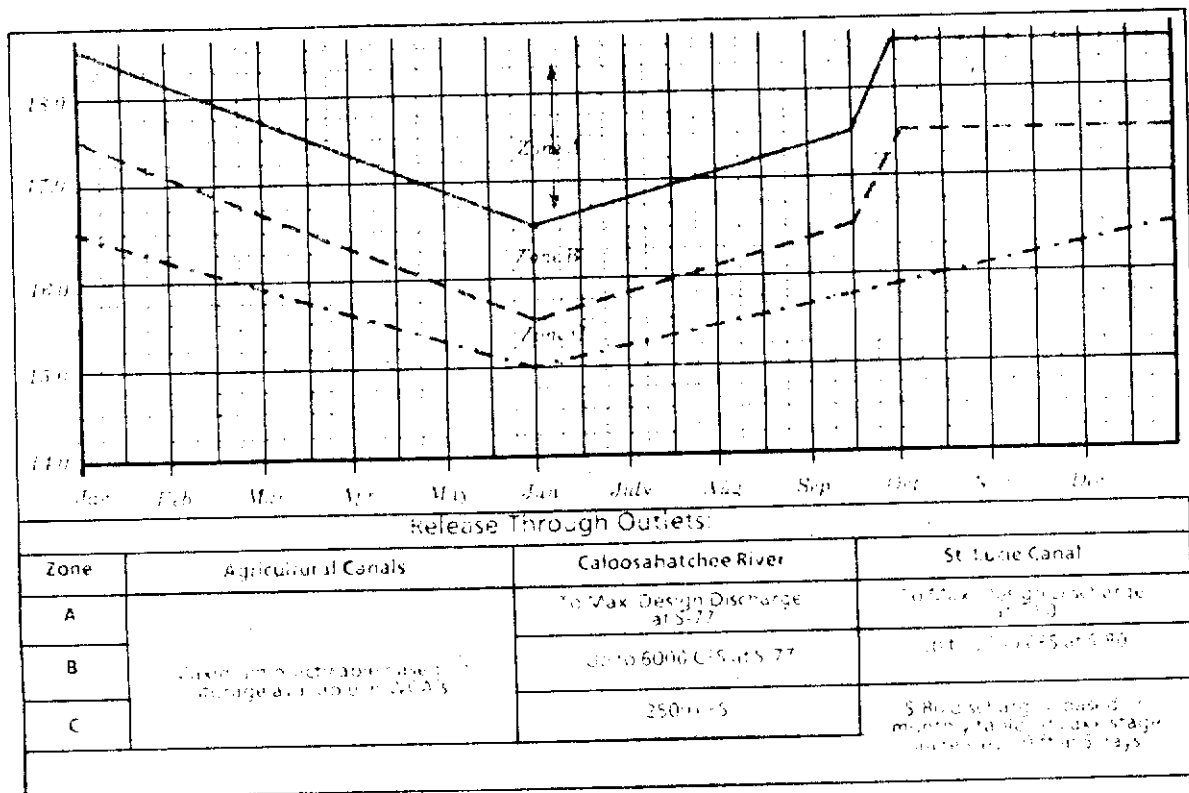


LAKE STAGE, WATER SUPPLY AND ESTUARY-IMPACT EVALUATION

YEAR	Extremes		LAKE OKEECHOBEE STAGES											% Demands Met		# of Days of Discharge**	
	MAX	MIN	Number of days Above Specified Stage											OK	101A	A	B
			10	11	12	13	14	15	16	17	18						
1963	14.55	11.61	365	365	218	114	37	0	0	0	0	95%	95%	0	0		
1964	14.92	12.12	365	365	365	222	197	0	0	0	0	95%	95%	0	0		
1965	15.32	12.10	365	365	365	313	239	70	0	0	0	95%	95%	0	0		
1966	17.50	15.06	365	365	365	365	365	365	213	97	0	95%	95%	12	0		
1967	17.00	13.24	365	365	365	365	249	170	91	0	0	95%	95%	0	0		
1968	17.49	12.06	366	366	365	314	272	187	177	74	0	95%	95%	44	0		
1969	18.70	15.30	365	365	365	365	365	365	255	127	54	95%	95%	157	0		
1970	18.07	15.04	365	365	365	365	365	365	137	96	4	95%	95%	157	0		
1971	15.15	11.32	365	365	284	219	162	14	0	0	0	95%	95%	0	0		
1972	14.33	12.91	365	366	366	354	154	0	0	0	0	95%	95%	0	0		
1973	15.19	12.09	365	365	365	247	119	33	0	0	0	95%	95%	0	0		
1974	16.66	10.57	365	325	238	255	205	151	139	0	0	95%	95%	0	0		
1975	16.37	12.80	365	365	365	341	212	15	3	0	0	95%	95%	0	0		
1976	14.90	12.09	365	366	366	314	150	0	0	0	0	95%	95%	0	0		
1977	14.77	12.01	365	365	365	236	117	0	0	0	0	95%	95%	0	0		
1978	16.69	14.23	365	365	365	365	365	130	140	0	0	95%	95%	0	0		
1979	17.50	13.58	365	365	365	365	310	264	191	115	0	95%	95%	0	0		
1980	17.42	14.29	366	366	365	366	366	225	115	38	0	95%	95%	0	0		
1981	14.33	9.83	325	215	104	75	14	0	0	0	0	95%	95%	0	0		
1982	17.61	10.42	365	224	196	191	184	180	137	93	0	95%	95%	0	0		
1983	17.91	15.11	181	191	181	181	181	131	130	100	0	95%	95%	115	0		

* Dashed record indicates that 100% of Demands were Met ** Number of Days of Discharge at Estuaries

FIG. 40 Present Lake Okeechobee Regulation Schedule And Summary



LAKE STAGE, WATER SUPPLY AND ESTUARY-IMPACT EVALUATION

LAKE OKEECHOBEE STAGES												% Dry Weather in Demand Met**		# Days Discharges**			
YEAR	Extremes		Number of Days Above Specified Stage										L. DEMAND	TOTAL	Zone		
	MAX	MIN	10	11	12	13	14	15	16	17	18	19			20	21	22
1963	14.84	11.74	365	315	243	111	37	0	0	0	0	0	0	0	0	0	0
1964	14.41	11.79	365	326	357	140	84	0	0	0	0	0	0	0	0	0	0
1965	14.22	11.76	365	365	345	275	172	0	0	0	0	0	0	0	0	0	0
1966	17.38	14.67	365	365	365	365	365	322	189	46	0	0	0	0	0	0	0
1967	16.73	12.26	365	365	365	310	211	37	22	0	0	0	0	0	0	0	0
1968	18.77	11.26	366	366	315	293	211	179	143	0	0	0	0	0	0	0	0
1969	17.37	15.12	365	365	353	365	365	365	276	27	20	0	0	0	0	0	0
1970	17.19	14.54	365	365	365	365	365	323	119	13	0	0	0	0	0	0	0
1971	17.16	13.78	365	274	223	189	33	0	0	0	0	0	0	0	0	0	0
1972	17.42	13.77	365	365	366	208	0	0	0	0	0	0	0	0	0	0	0
1973	14.43	11.71	365	365	231	130	39	0	0	0	0	0	0	0	0	0	0
1974	14.31	11.71	365	365	365	213	157	140	53	0	0	0	0	0	0	0	0
1975	14.20	11.72	365	365	331	213	127	22	0	0	0	0	0	0	0	0	0
1976	14.29	11.75	365	366	331	177	48	0	0	0	0	0	0	0	0	0	0
1977	14.21	11.74	365	365	254	132	66	0	0	0	0	0	0	0	0	0	0
1978	15.96	11.75	365	365	365	365	323	143	0	0	0	0	0	0	0	0	0
1979	17.08	13.23	365	365	365	365	293	227	179	5	0	0	0	0	0	0	0
1980	16.53	13.17	365	366	366	366	361	163	102	0	0	0	0	0	0	0	0
1981	14.81	9.42	294	155	38	61	4	0	0	0	0	0	0	0	0	0	0
1982	17.13	13.52	365	213	134	180	181	164	114	15	0	0	0	0	0	0	0
1983	17.54	14.30	181	181	181	181	181	164	121	53	0	0	0	0	0	0	0

* Dashed Record indicates that 100% of Demands were Met ** Number of Days of Discharges at S-77

FIG. 41 Proposed Lake Okeechobee Regulation Schedule And Summary

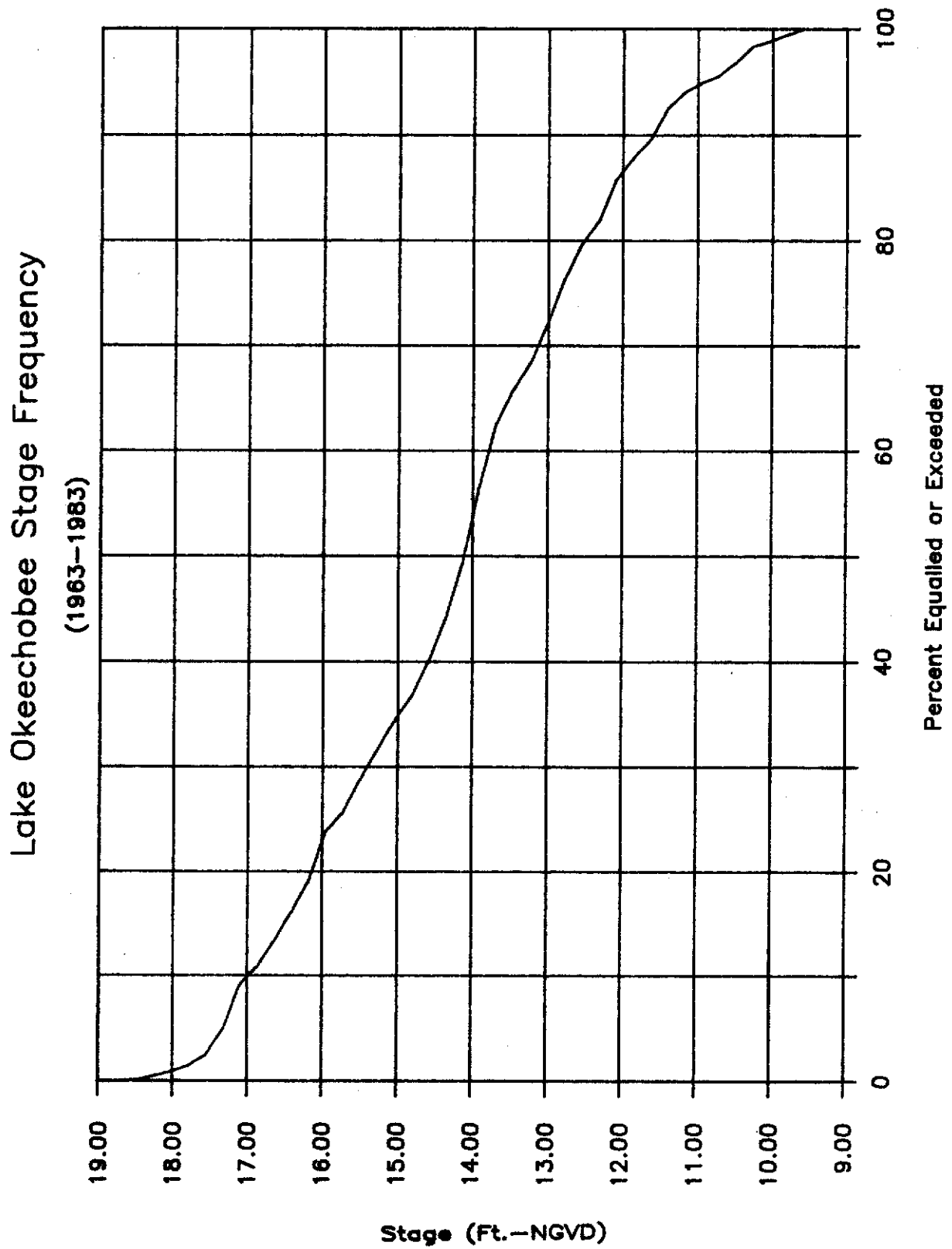


Fig. 42 Example of Stage Frequency Curves Generated

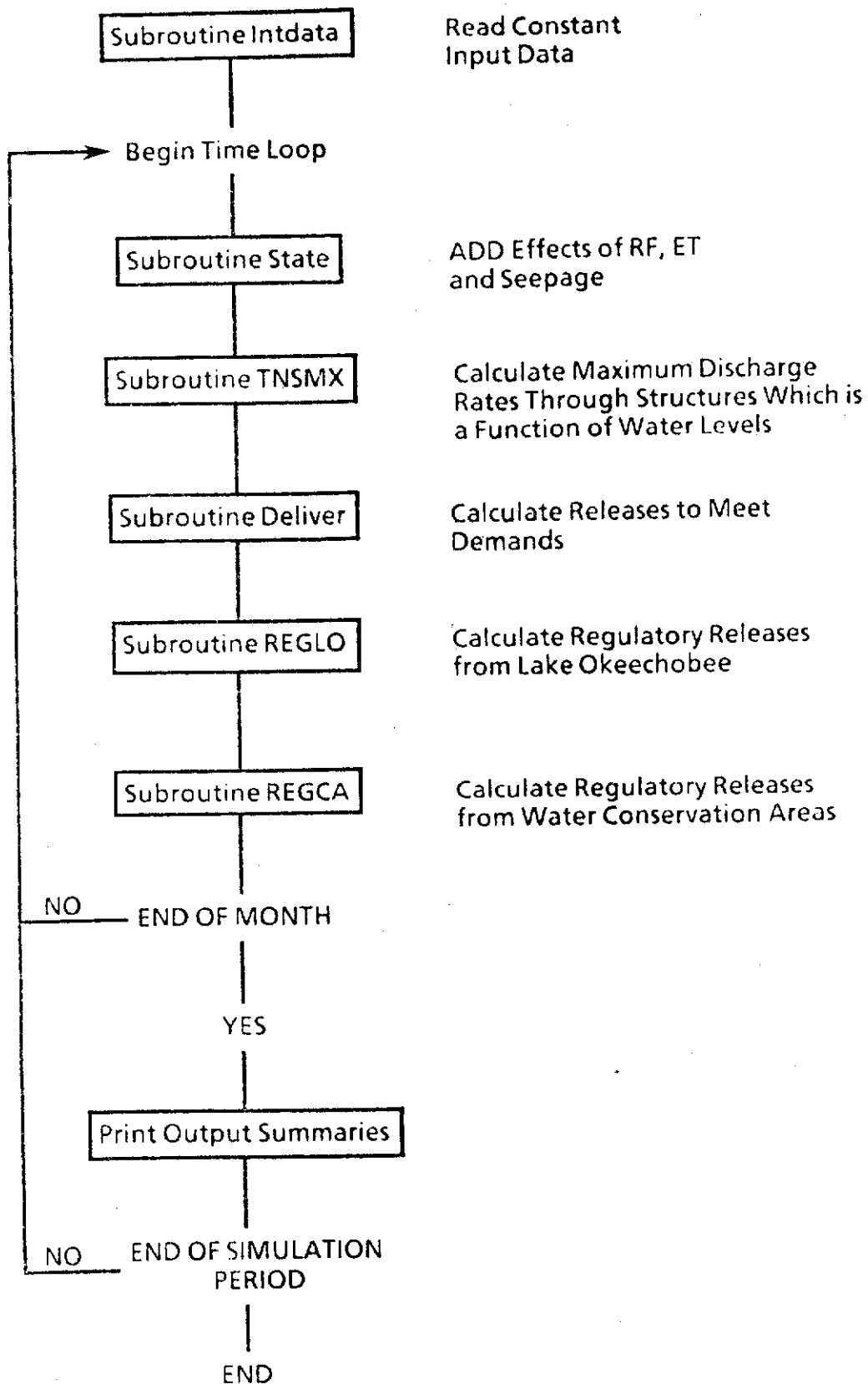


FIG. 43 Flow Chart of Main Program

new storage to stage. Once the new stages are determined, seepage rates across the eastern levees of the Water Conservation Areas can be calculated by the function subprogram SEEP. Daily seepage volumes are then added to the storage of the region they are flowing to and subtracted from the storage of the region they are flowing from. In addition, the daily regulation stages for Lake Okeechobee and the Water Conservation Areas are input. These are immediately converted to regulation storage by subroutine CTOSTO.

4. Subroutine CTOSTG converts storage to stage using the breakpoint stage-storage curves for each area, and a linear interpolation scheme.

5. Subroutine CTOSTO converts stage to storage using the same breakpoint stage-storage curve and a similar linear interpolation scheme.

6. Function SEEP calculates seepage across a levee as a function of head potential, length of levee, and a seepage coefficient. The equation for this computation is:

$$SEEP = (HP * LEN * COEFF)$$

where

HP - is the head potential (ft),

LEN - is the length of the levee (mile),

COEFF - is the seepage coefficient (cfs/ft- mile).

Figure 8 illustrates the values used for the seepage coefficient for the levees along the eastern boundaries of the Water Conservation Areas. The calling arguments of the function include the stages on both sides of a given levee and a number that dictates where calculated values will be stored in the computer memory.

7. Subroutine TNSMX determines the maximum flow rates through major discharge structures. These discharge rates are calculated daily because they are a function of the stages on any given day.

8. Subroutine DELIVER reads in the water use demands of the service areas each day, then estimates the amount of water available in each of the major surface water storage regions in the study area. When local storage does not meet the water requirements of a specific service area, this subroutine calculates deliveries from a surface water storage area which has available water to the service area in need. Lake Okeechobee is the only source of water for the Lake Okeechobee service areas. The Lower East Coast has the Biscayne Aquifer and the Water Conservation Areas as their primary source of water with Lake

Okeechobee as a backup source of water during periods when the Water Conservation Areas are dry.

9. Subroutine REGLO estimates the quantity of regulatory releases that are made from Lake Okeechobee to the Water Conservation Areas, and to the coast through the St. Lucie Canal and the Caloosahatchee River. Water would be delivered to the Water Conservation Areas rather than through the St. Lucie Canal or the Caloosahatchee River in an attempt to keep the water in the system for use during drier periods. If the Water Conservation Areas are over schedule, however, all the water must go through the St. Lucie Canal and the Caloosahatchee River to the Atlantic Ocean and the Gulf of Mexico, respectively, according to the specifications of the regulation schedule.

10. Subroutine REGCA calculates regulation releases out of the Water Conservation Areas. Primary releases are made through the S-10, S-11, and S-12 structures. If these releases are insufficient, additional releases may be made through coastal canals to the ocean. The amounts of these releases are dependent upon conditions in coastal canals. This subroutine has the added function of making sure that Everglades National Park receives its monthly minimum supply of water required for environmental purposes.

11. Subroutine PRINT sums daily discharges and prints stage and discharge sums on the seventh, fourteenth, twenty-first, and last day of each month.

The Fortran coding for these programs is contained in Appendix 3.

B. Variables

IYear	Counter for yearly iteration loop.
INTYear	First year model simulates.
LYear	Last year model simulates.
NYear	Total number of years model simulates.
MON	Indicates month of the year.
NDAY, NUMD	Number of days in a month.
IDAY	Day of the month.
STG (area)	Simulated stage for specified area.
STOMIN (area)	An amount of storage in each surface water reservoir not available for use.
XSTO (area, IB)	Breakpoint storages from breakpoint stage-storage curve.

XSTG (area, IB)	Breakpoint stages.
MM (area)	Number of breakpoints in stage-storage curve.
S12MIN (MON)	Minimum amount of water that should be delivered through the S-12 structures each month.
SWRC (A,B)	Surface water discharge from the Water Conservation Areas.
QMXC (A,B.)	Maximum possible discharge from the Water Conservation Areas at calculated stage. A - Indicates which conservation area. B - Indicates whether releases are made to the east or south.
SWRL (C)	Surface water discharges from Lake Okeechobee.
QMXL (C)	Maximum possible discharge through structures at the calculated stage. C - Indicates location of the release.
RGSTG (area)	Regulation schedule.
RGSTO (area)	Regulation storage.
DMND (area)	Service area demand.
GWR (area)	Groundwater release from each service area.
STOMAX (CSA)	Maximum storage capability for Lower East Coast service area.
SPOMIN (CSA)	Minimum amount of water lost due to seepage from the Lower East Coast service areas.
DEL (area)	Preprocessed change in storage.
SP	Array containing values of seepage from the Water Conservation Areas eastward.
STSTG	Stage estimated for S-10, S-11, S-12, based on average stages of Water Conservation Areas 1, 2A, and 3A. The relationship is determined from linear regression analysis. RM and B are the regression coefficients for the linear equation.
PKMET	Total amount of water delivered to Everglades National Park for a given month.
PKDM	Requirement for that same month.

C. Array Subscripts

LO	Lake Okeechobee.
ICA1	Water Conservation Area 1.
ICA2	Water Conservation Area 2A.
ICA3	Water Conservation Area 3A.
ICA2B	Water Conservation Area 2B.
ICA3B	Water Conservation Area 3B.
ISA1	Service Area 1.
ISA2	Service Area 2.
ISA3	Service Area 3.
ISTL	Releases through St. Lucie Canal.
ICAR	Releases through Caloosahatchee River.
ISW	Releases from Water Conservation Areas to the southwest (agricultural areas).
IE	Releases to the east from Water Conservation Areas.
IA, IAR	Indicates Lake Okeechobee, Water Conservation Areas 1, 2A, 3A; the Lower East Coast service areas 1, 2, and 3, depending on the value of IAR and IA.

IX. FUTURE IMPROVEMENTS TO THE MODEL

Future improvements largely depend on new major management options which may arise in the future. Certain improvements that are presently planned for the model are to include the Kissimmee River Basin in the routing model, and to define the service area demands by individual water use basins rather than lumping the entire service area together. This will require further refinements in the structure rating curves incorporated in the model for deliveries of water to the Lower East Coast. Also under investigation is the possibility of including structure rating curves for other hydraulic conditions which may exist at several of the structures for shorter periods of time; however, the structure rating curves presently in the model will remain the predominant curves under average conditions. The conveyance limitations incorporated between Lake Okeechobee and the Water Conservation Areas may need additional review, especially with the new hurricane structures presently under contract to be built.

Finally, updating the data base with hydrological data from the most recent years is a continuous process, thereby lengthening the period of record and improving the verification process.

X. SUMMARY

The purpose of this model is to aid water managers in developing the best regional operational policies possible for the present Lake Okeechobee and Lower East Coast hydrologic system. Also, to help them decide what changes need to be made to the present hydrologic system to meet future needs.

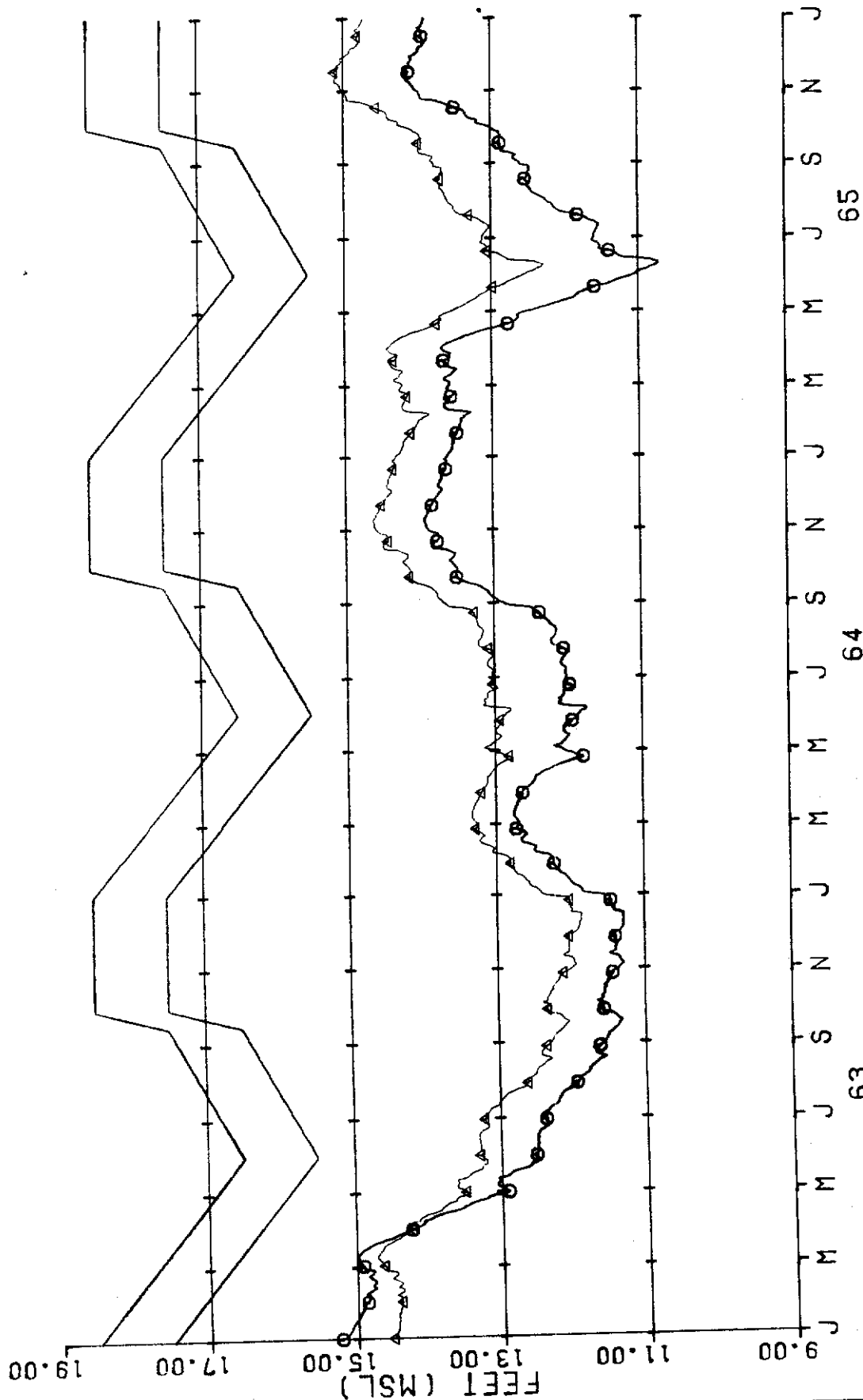
The advantages of the methodology used in this model are the quick response time and the minimization of certain error terms in the water budget associated with estimating evaporation, rainfall, and seepage. Verification of the model was made to check that the appropriate management schemes are incorporated into the model and that the new water use requirements are reasonable. With the methodology used in this model, when historical flows are imposed on the system the calculated stage will be equal to the historical stage by definition.

This model will be continually updated and refined to meet new needs of the District. The data base will also be continually updated with the most recent data available, and a major effort is presently being made to extend the model back in time to as early as 1915.

A large amount of effort has been put into making this model available to the casual user. A user guide exists in Appendix 2. The user, however, is still responsible for understanding the assumptions incorporated into the model and documented in this report to assure that this is the appropriate model to use for the specific analysis being contemplated.

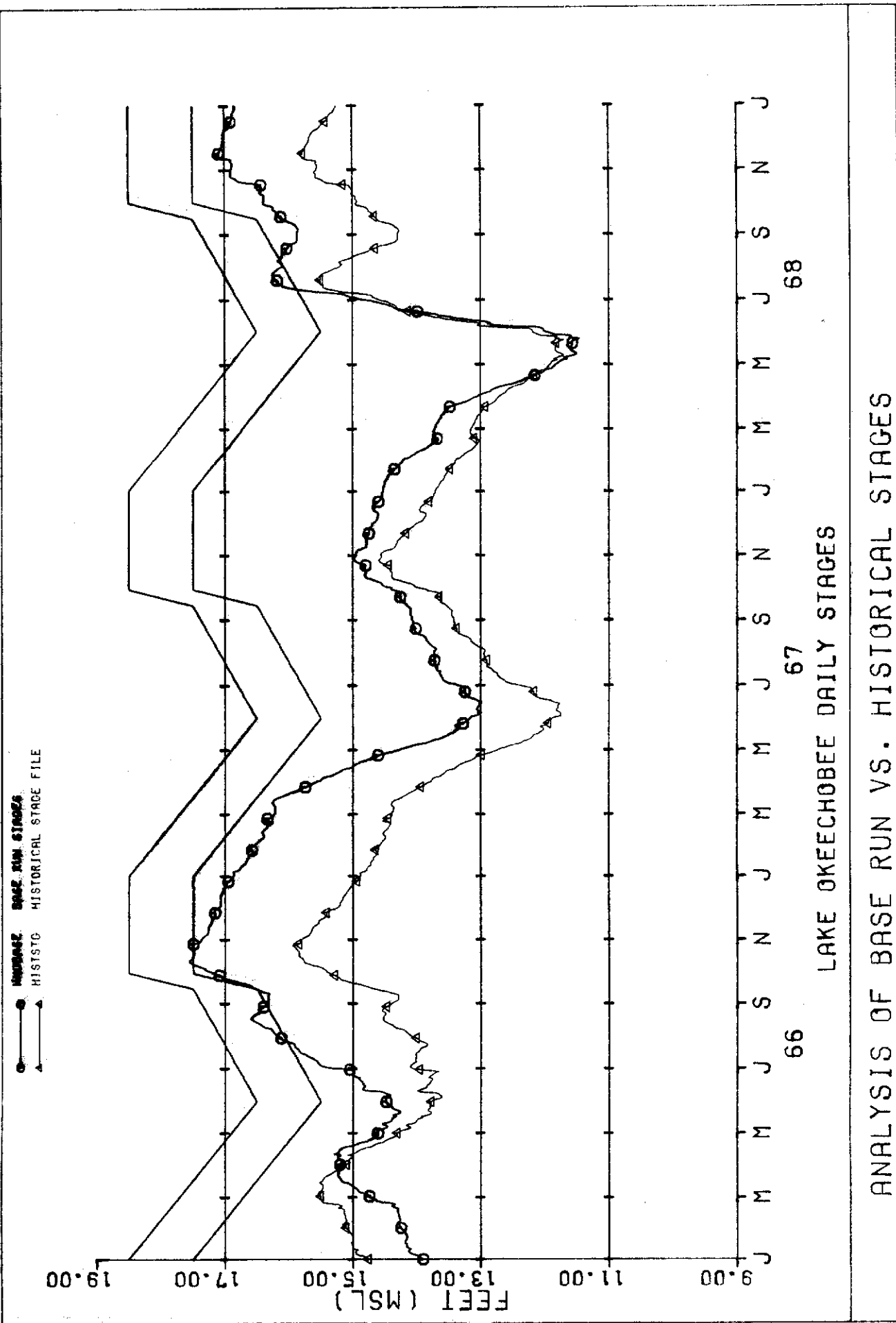
APPENDIX 1

● BASE RUN STAGES
 ○ HISTORICAL STAGES

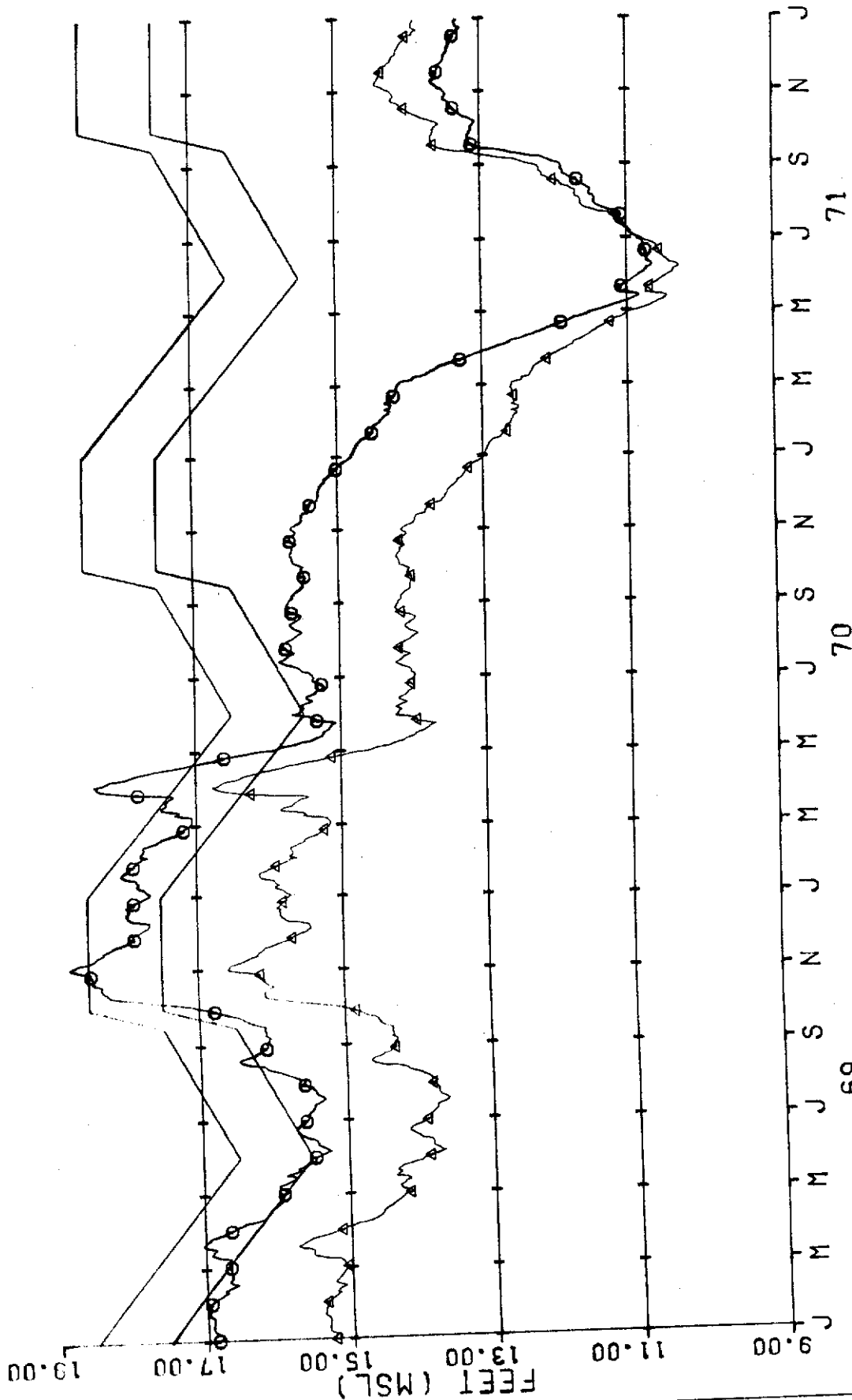


LAKE OKEECHOBEE DAILY STAGES

ANALYSIS OF BASE RUN VS. HISTORICAL STAGES





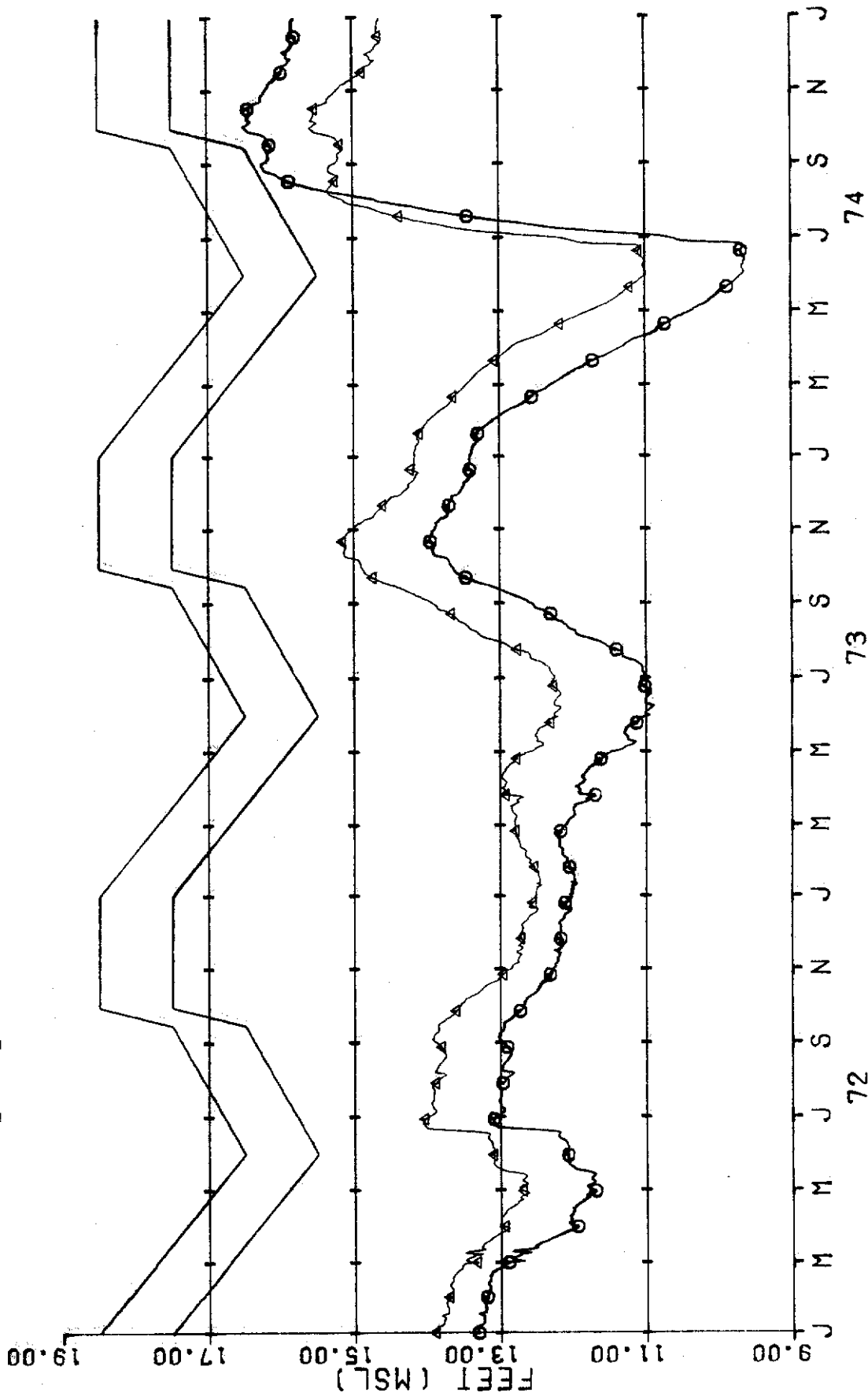
MEASURE BASE RUN STAGES
 HISTORICAL STAGE FILE



LAKE OKEECHOBEE DAILY STAGES





ANALYSIS OF BASE RUN VS. HISTORICAL STAGES

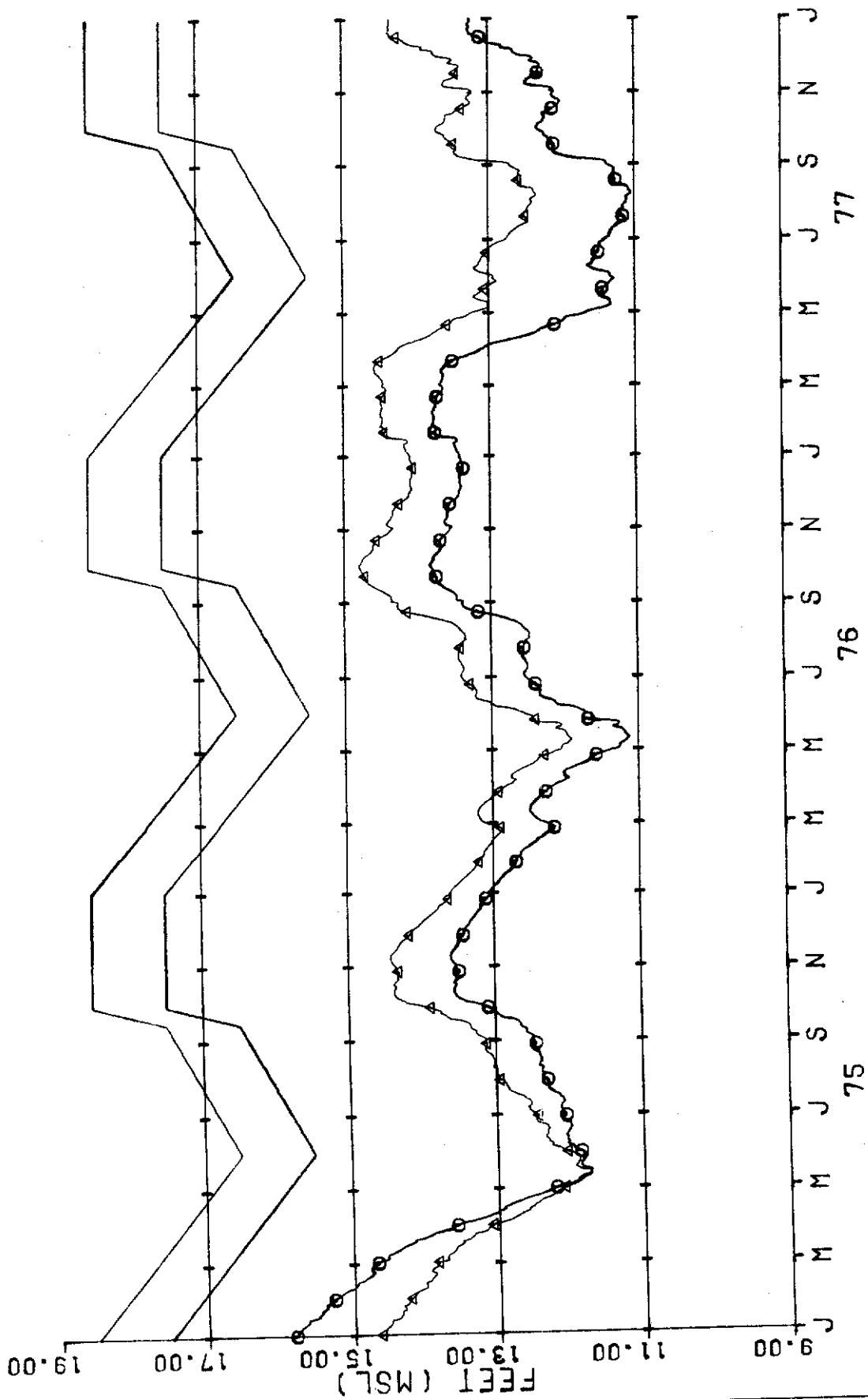
 IMAGE BASE RUN STAGES
 HISTSTG HISTORICAL STAGE FILE



LAKE OKEECHOBEE DAILY STAGES

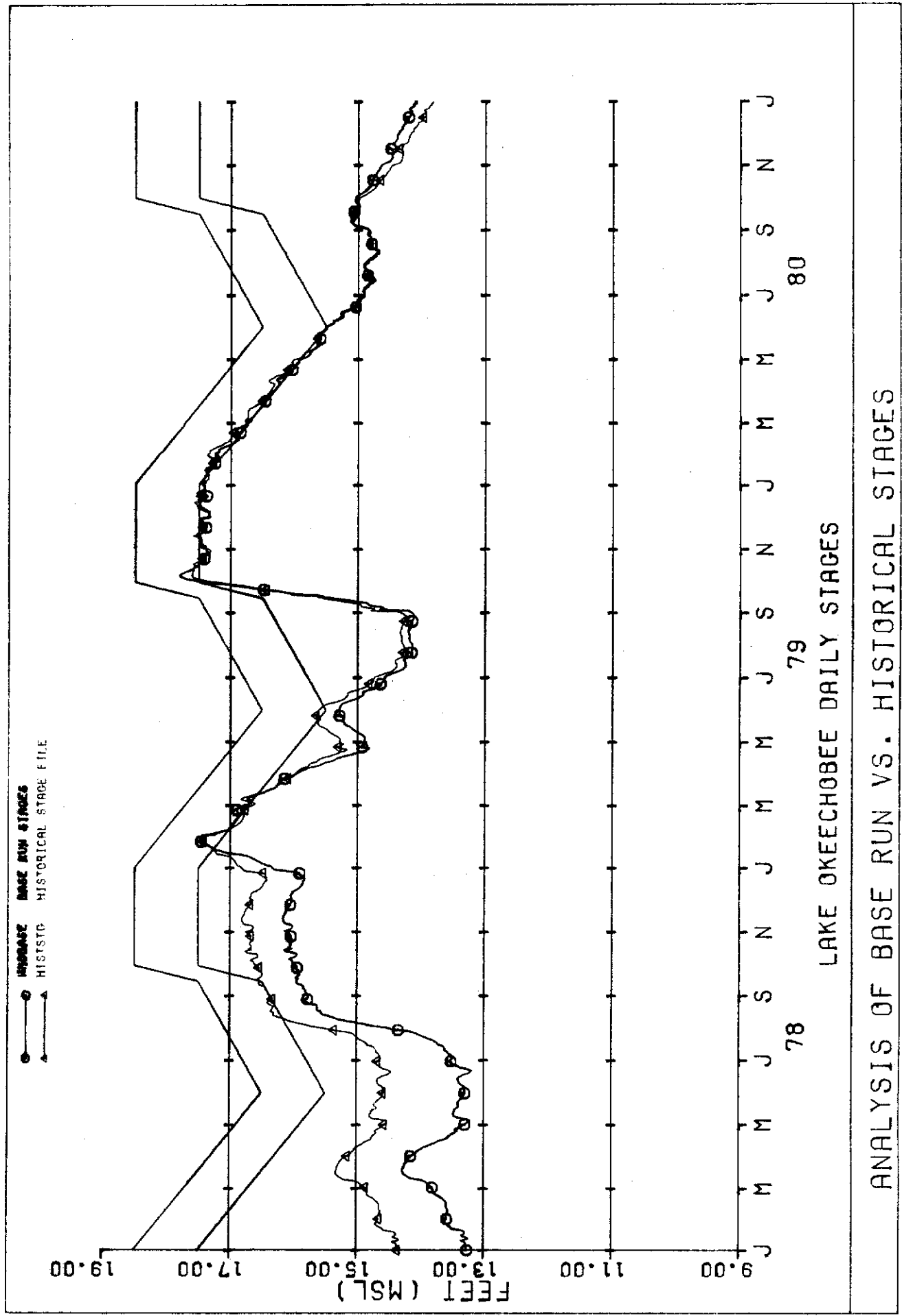
ANALYSIS OF BASE RUN VS. HISTORICAL STAGES

 WADSWORTH
 HISTORICAL
 BASE RUN STAGES
 HISTORICAL STAGE FILE

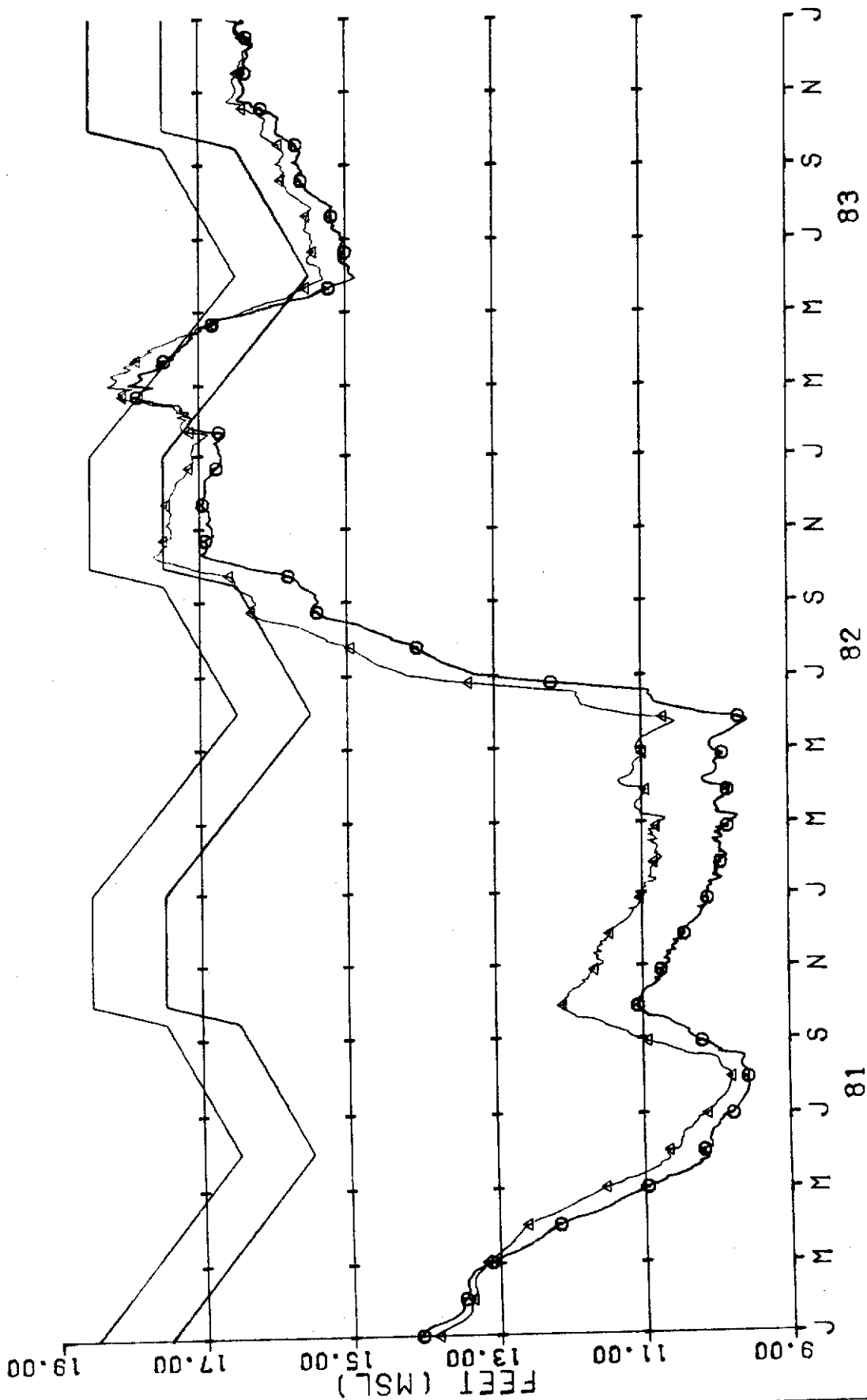


LAKE OKEECHOBEE DAILY STAGES

ANALYSIS OF BASE RUN VS. HISTORICAL STAGES



○ BASE RUN STAGES
 △ HISTORICAL STAGE FILE



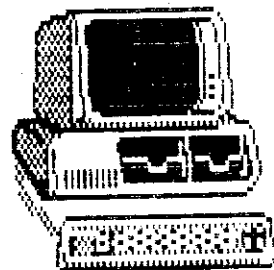
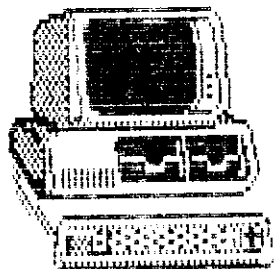
LAKE OKECHOBEE DAILY STAGES

ANALYSIS OF BASE RUN VS. HISTORICAL STAGES

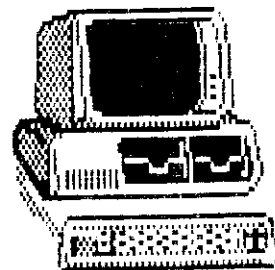
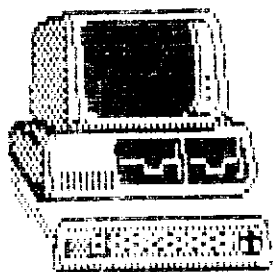
APPENDIX 2



POT



MODEL



"User-Friendly" POT Model

USER - FRIENDLY
LAKE OKKECHOBEE
LOWER EAST COAST
ROUTING MODEL

October 1985

Water Resources Division
Resource Planning Department
South Florida Water Management District
West Palm Beach, Florida

"User-Friendly" POT Model

TABLE OF CONTENTS

Abstract	Page 88
Introduction	Page 89
Program Description	Page 90
Input Description	Page 92
Miscellaneous	Page 102
Error Messages	Page 103
Sample "POT" Model Session	Page 104
Sample "POT" Output	Page 112
Other Associated Programs	Page 124
"BARPLOT" Description	Page 126
Sample "BARPLOT" Session	Page 129
"STGPLOT" Description	Page 131
Sample "STGPLOT" Session	Page 133
Sample "SDSF" Session	Page 135
Sample "WATBUD" Session	Page 136

"User-Friendly" POT Model

ABSTRACT

This is an inter-active, "user-friendly" program which allows the user to easily create, manipulate or retrieve regulation/cut-back schedule data and select various options or alternatives to be used by the "Lake Okeechobee - Lower East Coast ROUTING MODEL".

INTRODUCTION

A regional quantitative hydrological model was developed to simulate the water conditions of Lake Okeechobee, the Water Conservation Areas, and the Lower East Coast services areas. Within this documentation this model will be referred as either the "ROUTING MODEL" or the "POT MODEL". This model was designed as a management tool to study the relative effects of changes in management policy, regulation schedules, structure capacities and future demand levels on the regional water levels, and to forecast the behavior of the system under different rainfall conditions. Alternatives could be tested but it often required that extensive modifications be made to the program. As frequently "slightly" modified versions of the program have existed causing confusion as to which version of the model was used. The "ROUTING MODEL" has been modified and with the use of a "user-friendly" program described in this document, many of the alternatives can be tested with only modifications to the input data.

The interactive "user-friendly" program allows a user to respond to a series of questions in which the user can select the current operating regulation schedules, select previously defined alternative regulation schedules, or create new alternative regulation schedules. The user also has the ability to describe cut-back regulation schedules, determine the percentage cut-back, the regulatory discharges of various structures within the system, determine whether stages are to be maintained, whether the Everglades National Park demands be met, or whether the "Interim Action Plan" is in effect or not. The program retains the input data files created by the user in his or her computer user group for later retrievals or to be used with other alternatives. While executing the "user-friendly" program, many of the user's entries are verified, appropriate error messages are generated, usually indicating what the correct response should be. At the end of certain phases of entry, the program will ask the user to reply whether the data entered is correct and allow the user to re-enter the revised data. The program also echoes back the input used in each execution of the program, thus eliminating the confusion of what alternative was used and or what input files were used.

"User-Friendly" POT Model

PROGRAM DESCRIPTION

The inter-active, "user-friendly" program will prompt the user with a series of questions for Lake Okeechobee, Conservation Areas 1, 2A, 3A, 2B, and 3B. For the lake and each conservation area, the user will have the opportunity to select an **ESTABLISHED** file (the current management option), a **PREVIOUSLY DEFINED** file (a management option created in a previous run), or **NEW** file (create a new management option within this run).

If **NEW** is selected, the user will be asked the number of lines on the regulation and the cut-back schedules. The user will then be prompted to enter the "break-point" (date and stage elevation) data for each line on the appropriate schedule. Next, the user will be asked to supply the actual discharge value or a percentage value of the discharge (computed from the structure's (in questioned) rating curve) for each line on the regulation schedule. If there is a cut-back schedule, the user will be asked to enter the percentage of the demands to be met during drought periods for each line. A comment (remark) may be included in the file which will differentiate this file from other previously defined files that may have been created for the particular area in previous executions. The user will also be asked to enter the elevation at which "water supply" is impossible to deliver and if water is available in Lake Okeechobee, whether or not the stages should be maintained in the particular area. For Conservation Area 3A, the user will be asked whether or not the Everglades National Park demands should always be met. The user will then be requested to give this newly created file a name.

For the lake and each conservation area, the user will be asked if there are any additional flow information (into or out of the area in question). If the response is **YES**, the user will be asked to enter the name of the file. The "additional flow" file must meet three criteria, 1.) it already exists in the user's account, 2.) be a "direct access" file and 3.) must have "public" access permission. The user will indicate whether or not the "additional flow" information always be added to storage.

The user will then be asked if the "Interim Action Plan" is to be put into effect and to enter a file name for the "output" to be stored.

The program will automatically save (or replace if file name already exists) the "output" file name and if any newly created regulation/cut-back schedules files, The program will also create three (3) additional files ("WDMESS" (which contains the status of the batch job or the "dayfile" when the batch job is completed), "WDJOB" (the batch job "control cards"), and "OPTIONS" (the current options selected for this execution). Files created will be stored in the user's account with the appropriate access permission. The batch job "control cards" (WDJOB) will automatically be routed to the central site computer; thus freeing the user's terminal.

"User-Friendly" POT Model

The "output" file will contain the following: 1.) the "output" file name in enlarged characters, 2.) the data contained in each regulation / cut - back schedule file (either the **ESTABLISHED**, **PREVIOUSLY DEFINED**, or **NEWLY DEFINED** file), 3.) the options selected for this execution (**OPTIONS**), 4.) the daily values (January 1 to December 31) of all the regulation / cut - back schedules, 5.) the computed stage and storages for Lake Okeechobee and Water Conservation Areas 1, 2A, 3A, 2B, and 3B, 6.) the calculated deliveries from Lake Okeechobee, 7.) the calculated deliveries from the Water Conservation Areas.

"User-Friendly" POT Model

INPUT DESCRIPTION

STEP 0.

MODIFY INFORMATION FOR -

- "0" - Allows the user to "exit" the regulation schedule input
- "1" - Lake Okeechobee
- "2" - Conservation Area 1
- "3" - Conservation Area 2A
- "4" - Conservation Area 3A
- "5" - Conservation Area 2B
- "6" - Conservation Area 3B

If "1-6", go to step 1.

If "0", go to step 16.

*** NOTE ***

An Asterisk within the parenthesis indicates that you have already made a modification of the designated area.

STEP 1.

SELECT REGULATION SCHEDULE FOR
<E>STABLISHED, <P>REVIOUSLY DEFINED, <N>EW, <?>

- "E" - Selects the established (current) operating schedule for the area in question.
- "P" - Indicates that a previously defined file is to entered (name supplied later).
- "N" - Indicates that a new regulation / cut - back schedule is to be created.
- "?" - Selects the "HELP" screen (On-line documentation). Describes the "E", "P", and "N" choices.

If "E", go to step 16.

If "P", go to step 2.

If "N", go to step 3.

If "?", go to step 1.

"User-Friendly" POT Model

STEP 2.

ENTER FILE NAME OF PREVIOUSLY DEFINED SCHEDULE

Enter a file name, up to seven (7) characters, for the schedule to be used for the area in question.

If a carriage return (c/r) with no characters in the entry, an "Error Message" will be generated.

***** NOTE *****

1. No check is made for the file's existence (during inter-active session) 2. A regulation / cut - back schedule file can be created externally (ie. "XEDIT"), but be sure that the file is an "indirect" access file and is made "public".

Go to step 16.

STEP 3.

HOW MANY LINES ARE ON THE SCHEDULE (MAXIMUM = 4)

The number of lines that described the regulation schedule only.

You must select a number between 1 and 4; inclusively.

An entry less than 1 or greater than 4 will generate an "Error Message".

STEP 4.

HOW MANY LINES ON THE CUT-BACK SCHEDULE (MAXIMUM = 4)

The number of lines that described the cut-back schedule.

You must select a number 0 and 4; inclusively.

An entry less than 0 or greater than 4 will generate an "Error Message".

"User-Friendly" POT Model

STEP 5.

YOU WILL ENTERING THE NEW REGULATION SCHEDULE FOR
LINE NUMBER xx OF yy
ENTRY NUMBER zz

Where - .. is the name of the area
 xx is the number of the line being entered
 yy is the number of lines on the schedule
 zz is the current entry number

Format is **month (numeric), day (numeric), elevation (in feet).**

The initial entry of each line must start with January 1.

Dates not in sequential order will generate an "Error Message".

A carriage return (c/r), will terminate entries for the current line.

STEP 6.

FOR THE {DECLINING/RISING} CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH
A CARRIAGE RETURN WILL GENERATE * HELP *****
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5)
ENTER THE DELTA CHANGE OF STAGE (FT)
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR

Where - .. is the name of discharge structure or the area to
 which the discharge will flow

An entry greater than five (5) indicates that when the stage is above the current line being described; this will be the regulatory discharge to or through the structure or conveyance system.

An entry less than or equal to five (5) indicates that when the stage is above the current line being described; the "ROUTING MODEL" will compute the discharge based upon its structure rating curve; then multiply it by the value you entered. Therefore; an entry of .5 would indicate to use half of the computed discharge, an entry of 2 would indicate to discharge twice as much as was computed.

A negative entry will generate an "Error Message".

A carriage return (c/r) will generate a "HELP" screen.

"User-Friendly" POT Model

STEP 7.

IS THIS CORRECT <Y>ES OR <N>O

"Y" indicates that the information currently being displayed is correct and to continue processing.

"N" indicates that the information currently being displayed is not correct and that the information needs to be re-entered.

If "Y", go to Step 8.

If "N", go to Step 5.

STEP 8.

If a zero (0) was entered in Step 4.

(Number of Cut-Back Schedule Lines), go to Step 11.

YOU WILL ENTERING THE NEW CUT - BACK SCHEDULE FOR
LINE NUMBER xx OF yy
ENTRY NUMBER zz

Where - .. is the name of the area
xx is the number of the line being entered
yy is the number of lines on the schedule
zz is the current entry number

Format is **month (numeric), day (numeric), elevation (in feet).**

The initial entry of each line must start with January 1.

Dates not in sequential order will generate an "Error Message".

A carriage return (c/r), will terminate entries for the current line.

STEP 9.

ENTER PERCENTAGE OF DEMANDS MET DURING DROUGHT PERIODS

A carriage return (c/r) will generate a default value of 0.8 or 80 percent.

An entry less than zero (0) or greater than one (1) will generate an "Error Message"

"User-Friendly" POT Model

STEP 10.

IS THIS CORRECT <Y>ES OR <N>O

"Y" indicates that the information currently being displayed is correct and to continue processing.

"N" indicates that the information currently being displayed is not correct and that the information needs to be re-entered.

If "Y", go to Step 11.

If "N", go to Step 8.

STEP 11.

AN ADDITIONAL COMMENT CAN BE ADDED TO THE REGULATION SCHEDULE FILE TO DIFFERENTIATE IT FROM OTHER VERSIONS ... ENTER COMMENT-

This comment can be up to sixty (60) characters long (about the space remaining on the line where the user is prompted.

It is used to self document the input data information.

A carriage return (c/r) with no characters in the line indicates that a comment was not required.

STEP 12.

ENTER THE ELEVATION AT WHICH WATER SUPPLY IS IMPOSSIBLE

The elevation (in feet) when water supply (demands) cannot be met.

No comparison is made with the regulation file.

A carriage return (c/r) will generate a "HELP" screen.

"User-Friendly" POT Model

STEP 13.

IF WATER IS AVAILABLE IN LAKE OKEECHOBEE, DO YOU WANT TO MAINTAIN THE STAGE IN

The valid responses are **Yes** or **No**.

"Y" indicates that

"N" indicates that

A carriage return (c/r) or incorrect response will generate an "Error Message".

STEP 14.

This question only applies to Conservation Area 3A, otherwise go to Step 15.

SHOULD THE EVERGLADES NATIONAL PARK (ENP) DEMAND ALWAYS BE MET

The valid responses are **Yes** or **No**.

"Y" indicates that

"N" indicates that

STEP 15.

ENTER FILE NAME OF THE NEWLY DEFINED SCHEDULE

Enter a file name, up to seven (7) characters, for the schedule to be used for the area in question.

***** NOTE *****

1. This file will be saved (or replaced if file name already exists) providing that there is room in the users' file space.

"User-Friendly" POT Model

STEP 16.

ARE THERE ANY ADDITIONAL FLOWS INTO OR OUT OF

The valid responses are **Yes** or **No**.

If additional flow information is required then

1. The must exists in the user's computer account.
2. It must be a "direct access" file.
3. It must have "public access" permission.

The format of the additional flow information is as follows:

If "N", go to Step 21.

If "Y", go to Step 17.

STEP 17.

ENTER THE NUMBER OF FILES FOR

The valid responses are **1** or **2**.

STEP 18.

ENTER FILE NAME

Enter a file name, up to seven (7) characters.

***** NOTE *****

1. If your responses was two (2) in Step 17, this question will be repeated a second time.

STEP 19.

IS IT ALWAYS ADDED TO STORAGE

The valid responses are **Yes** or **No**.

"Y" indicates that the "additional flow" information is

"N" indicates that the "additional flow" information is

If "Y", go to Step 20.

If "N", go to Step 0.

"User-Friendly" POT Model

STEP 20.

ENTER THE LINE NUMBER FOR WHEN IT IS ADDED

Since the maximum number of lines on a schedule is four (4), the valid responses are 1, 2, 3, or 4.

No verification is made with the regulation / cut-back schedule file.

STEP 21.

**DO YOU WANT THE "INTERIM ACTION PLAN" IN EFFECT
<Y>ES OR <N>O**

The valid responses are **Yes** or **No**.

"Y" indicates that the "Interim Action Plan" will be placed in effect.

"N" indicates that the "Interim Action Plan" will not be placed in effect.

Interim Action Plan - is the routing scheme based on the current regulation schedules for Lake Okeechobee and the Water Conservation Areas and no backpumping to Lake Okeechobee is allowed unless flooding conditions exist in the EAA. Runoff from S-2 and S-3 Basins would be primarily pumped into the Water Conservation Areas via S-6, S-7, and S-8 pump stations.

STEP 22.

**IS S-12 & S-333 OPERATED BY THE "RAINFALL DRIVEN" PLAN
<Y>ES OR <N>O [DEFAULT = YES]**

STEP 23.

PERIOD OF DATA

START DATE (MM/DD/YY) [DEFAULT=01/01/63]
END DATE (MM/DD/YY) [DEFAULT=06/30/83]

STEP 24.

ENTER THE INITIAL WATER ELEVATION FOR
[DEFAULT = 14.53] ----- {LAKE OKEECHOBEE}
[DEFAULT = 15.72] ----- {CONSERVATION AREA 1}
[DEFAULT = 13.04] ----- {CONSERVATION AREA 2A}
[DEFAULT = 8.80] ----- {CONSERVATION AREA 3A}
[DEFAULT = 6.77] ----- {CONSERVATION AREA 2B}
[DEFAULT = 7.36] ----- {CONSERVATION AREA 3B}

"User-Friendly" POT Model

STEP 25.

**DO YOU WANT TO RE-INITIALIZE THE STAGE IN ANY AREA
EACH YEAR (<Y>ES OR <N>O [DEFAULT = NO])**

This option allows the user to reset elevations of one or all
of the areas to a pre-determined value on a specific date each
year.

If "N", go to Step 28.

If "Y", go to Step 26.

STEP 26.

ENTER MONTH AND DAY (MM,DD) TO RE-INITIALIZE STAGE

STEP 27.

**ENTER THE RE-INITIALIZED STAGE VALUE FOR
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA])**

Where - .. is the name of the area

STEP 28.

**ENTER THE FILE NAME OF THE "DEMAND" INFORMATION
[DEFAULT = "ESTDMD" (ESTABLISHED DEMANDS)]**

STEP 29.

**ENTER THE FILE NAME OF THE "MODIFIED DELTA STORAGE"
DATA TO BE USED
[DEFAULT = "ESTMDS" (ESTABLISHED MOD. DELTA STORAGE)]**

STEP 30.

**SPECIAL EVENT INFORMATION (CHANGES TO HISTORICAL STORAGE)
ENTER "SPECIAL EVENT" INFORMATION FILE NAME
[DEFAULT = "NOEVENT"]**

"User-Friendly" POT Model

STEP 31.

ENTER "OUTPUT" FILE NAME

Enter a file name, up to seven (7) characters.

The file will contain all the "output" generated

1. The regulation / cut-back schedules for each area
2. The options selected.
3. The daily values of all the regulation / cut-back schedules.
4. The computed stage and discharge values in Lake Okeechobee.
5. The computed stages and discharges in each conservation area.

"User-Friendly" POT Model

MISCELLANEOUS

Naming files on the CDC Cyber computer

A file name consists of a unique string of seven (7) or less alphanumeric characters. Although NOS (Network Operating System) allows file names that begin with a digit, many of its products (Fortran, for example) do not support such file names.

"User-Friendly" POT Model

ERROR MESSAGES

Error () -Correct Responses are [E, P, N, ?]

1. Type **E**, to select "Established" regulation file.
2. Type **P**, to select "Previously Defined" regulation file.
3. Type **N**, to select "New" (create a new) regulation file.
4. Type **?** or **(c/r)**, to select the "HELP" screen.

Error () - I need a File Name

1. Enter up to a seven (7) character file name.

Error () - Correct Responses are [(0), 1, 2, 3, 4]

1. For regulation schedule, there must be at least one line.
2. For cut - back schedule, there can be "no" entries.

Error () - Initial Entry NOT January 1

1. The initial entry of each line (regulation or cut-back) must begin with " 1, 1, {breakpoint stage value}"

Error () - Dates are NOT Increasing

1. Enter a {month,day} greater than previous date.

Error () - Release Discharge Below Zero

1. Enter a {positive} discharge value in cfs.

Error () - Correct Responses are [Y, N]

1. Enter a "Y" or "N"

Error () - Correct Responses are "1" or "2"

1. Up to two (2) "additional flow" files can be read per area.

Error () - I Need a Number Please

1. When the stage is "above" this line number, the "additional flow" information is "added" to storage.
2. The valid responses are 1, 2, 3, or 4.

(xxxx) - indicates the location within the program.

"User-Friendly" POT Model

SAMPLE SESSION

In the "sample session" to be described, the following conventions have been utilized:

1. **Boldface** characters indicate the user's entry.
2. (c/r) indicates only a carriage return key with no other characters was depressed.

The "sample session" is only used to demonstrate the type of response the user could expect.

"User-Friendly" POT Model

-pot,uf

```
*****
*           U S E R - F R I E N D L Y           *
*                                           *
*           L A K E   O K E E C H O B E E       *
*                                           *
*           L O W E R   E A S T   C O A S T     *
*                                           *
*           R O U T I N G   M O D E L           *
*                                           *
*****
```

--- COMPILING "POT" MODEL INTERFACE PROGRAM

COMPILATION COMPLETED

--- EXTRACTING "ESTABLISHED" FILES

--- EXECUTING "POT" MODEL INTERFACE PROGRAM

```
* * * * *
* * * * *
```

USER-FRIENDLY "POT" MODEL

TYPE TO MODIFY INFORMATION FOR

- 1 () LAKE OKEECHOBEE
- 2 () CONSERVATION AREA 1
- 3 () CONSERVATION AREA 2A
- 4 () CONSERVATION AREA 3A
- 5 () CONSERVATION AREA 2B
- 6 () CONSERVATION AREA 3B
- 0 TO EXIT THIS PHASE

* - MODIFIED DURING THIS SESSION

MAKE SELECTION - ? 1

```
* * * * *
* * * * *
```

SELECT REGULATION SCHEDULE FOR LAKE OKEECHOBEE
<E>STABLISHED, <P>REVIUOUSLY DEFINED, <N>EW, <?>-HELP ? n

HOW MANY LINES ARE ON THE SCHEDULE (MAXIMUM = 4) ? 1

HOW MANY LINES ON THE CUT-BACK SCHEDULE (MAXIMUM = 4)? 1

"User-Friendly" POT Model

YOU WILL BE ENTERING THE NEW REGULATION FOR LAKE OKEECHOBEE
LINE NUMBER 1 OF 1

THE FORMAT IS MONTH, DAY, STAGE
THE FIRST ENTRY MUST BE "1,1,STAGE"
THE DATES MUST BE IN SEQUENTIAL ORDER
A CARRIAGE RETURN WILL TERMINATE THIS ENTRY PHASE

ENTRY NUMBER 1 ? 1,1,16.5
ENTRY NUMBER 2 ? 3,1,15.5
ENTRY NUMBER 3 ? 6,1,15.5
ENTRY NUMBER 4 ? 9,15,16.5
ENTRY NUMBER 5 ? (c/r)

FOR THE DECLINING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH CA-1
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .5
ENTER THE DELTA CHANGE OF STAGE (FT) ? .25
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 10

FOR THE RISING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH CA-1
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .75
ENTER THE DELTA CHANGE OF STAGE (FT) ? .2
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

FOR THE DECLINING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH CA-2A
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .3
ENTER THE DELTA CHANGE OF STAGE (FT) ? .2
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

FOR THE RISING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH CA-2A
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .7
ENTER THE DELTA CHANGE OF STAGE (FT) ? .25
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 4

"User-Friendly" POT Model

FOR THE DECLINING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH CA-3A
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .5
ENTER THE DELTA CHANGE OF STAGE (FT) ? .3
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

FOR THE RISING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH CA-3A
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .8
ENTER THE DELTA CHANGE OF STAGE (FT) ? .25
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 3

FOR THE DECLINING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH S-77
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .5
ENTER THE DELTA CHANGE OF STAGE (FT) ? .2
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

FOR THE RISING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH S-77
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .7
ENTER THE DELTA CHANGE OF STAGE (FT) ? .25
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

FOR THE DECLINING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH S-80
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .3
ENTER THE DELTA CHANGE OF STAGE (FT) ? .2
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

FOR THE RISING CYCLE, ENTER THE
REGULATORY DISCHARGE TO OR THROUGH S-80
A CARRIAGE RETURN WILL GENERATE *** HELP ***
ENTER RELEASE DISCHARGE (>5) OR PERCENTAGE (0-5) ? .7
ENTER THE DELTA CHANGE OF STAGE (FT) ? .3
ENTER THE NUMBER OF DAYS IN WHICH THE CHANGE CAN OCCUR ? 5

"User-Friendly" POT Model

***** LAKE OKEECHOBEE

STRUCT NAME	STAGE CYCLE	DELTA STAGE	NUMBER OF DAYS	DISCHARGE
CA-1	FALL	.25	10.00	50.00%
CA-1	RISE	.20	5.00	75.00%
CA-2A	FALL	.20	5.00	30.00%
CA-2A	RISE	.25	4.00	70.00%
CA-3A	FALL	.30	5.00	50.00%
CA-3A	RISE	.25	3.00	80.00%
S-77	FALL	.20	5.00	50.00%
S-77	RISE	.25	5.00	70.00%
S-80	FALL	.20	5.00	30.00%
S-80	RISE	.30	5.00	70.00%

DATE STAGE - REGULATION SCHEDULE OF LINE 1
 01/01 16.50
 03/01 15.50
 06/01 15.50
 09/15 16.50

IS THIS CORRECT <Y>ES OR <N>O ? **y**

YOU WILL BE ENTERING THE NEW CUT - BACK FOR LAKE OKEECHOBEE
 LINE NUMBER 1 OF 1

THE FORMAT IS MONTH, DAY, STAGE
 THE FIRST ENTRY MUST BE "1,1,STAGE"
 THE DATES MUST BE IN SEQUENTIAL ORDER
 A CARRIAGE RETURN WILL TERMINATE THIS ENTRY PHASE

ENTRY NUMBER 1 ? **1,1,12.25**
 ENTRY NUMBER 2 ? **3,31,11.5**
 ENTRY NUMBER 3 ?
 ENTER PERCENTAGE OF DEMANDS MET DURING DROUGHT PERIODS
 (<=1, DEFAULT = .8) ? **(c/r)**

***** LAKE OKEECHOBEE

CUT - BACK PERCENTAGE IS 80.
 DATE STAGE - REGULATION SCHEDULE OF LINE 2
 01/01 12.25
 03/31 11.50

IS THIS CORRECT <Y>ES OR <N>O ? **y**

AN ADDITIONAL COMMENT CAN BE ADDED TO THE REGULATION
 SCHEDULE FILE TO DIFFERENTIATE IT FROM OTHER VERSIONS
 60 CHARACTERS MAXIMUM, SPACE REMAINING ON THE LINE
 OR A CARRIAGE RETURN (CR), IF NONE

"User-Friendly" POT Model

ENTER COMMENT- ? **just a test case**

ENTER THE ELEVATION AT WHICH WATER SUPPLY IS IMPOSSIBLE ? **10.3**

ENTER FILE NAME OF THE NEWLY DEFINED SCHEDULE ? **laketst**

ARE THERE ANY ADDITIONAL FLOWS INTO OR OUT OF LAKE OKEECHOBEE
<Y>ES OR <N>O ? **n**

USER-FRIENDLY "POT" MODEL

TYPE TO MODIFY INFORMATION FOR

- 1 (*) LAKE OKEECHOBEE
- 2 () CONSERVATION AREA 1
- 3 () CONSERVATION AREA 2A
- 4 () CONSERVATION AREA 3A
- 5 () CONSERVATION AREA 2B
- 6 () CONSERVATION AREA 3B
- 0 TO EXIT THIS PHASE

* - MODIFIED DURING THIS SESSION

MAKE SELECTION - ? **0**

DO YOU WANT THE "INTERIM ACTION PLAN" IN EFFECT
<Y>ES OR <N>O ? **y**

IS S-12 & S-333 OPERATED BY THE "RAINFALL DRIVEN" PLAN
<Y>ES OR <N>O [DEFAULT = YES] ? **(c/r)**

PERIOD OF DATA

START DATE (MM/DD/YY) [DEFAULT=01/01/63] ? **(c/r)**

END DATE (MM/DD/YY) [DEFAULT=06/30/83] ? **(c/r)**

ENTER INITIAL WATER ELEVATION FOR LAKE OKEECHOBEE
[DEFAULT = 14.53 FT] ? **15.25**

ENTER INITIAL WATER ELEVATION FOR CONSERVATION AREA 1
[DEFAULT = 15.72 FT] ? **(c/r)**

ENTER INITIAL WATER ELEVATION FOR CONSERVATION AREA 2A
[DEFAULT = 13.04 FT] ? **12**

ENTER INITIAL WATER ELEVATION FOR CONSERVATION AREA 3A
[DEFAULT = 8.8 FT] ? **(c/r)**

ENTER INITIAL WATER ELEVATION FOR CONSERVATION AREA 2B
[DEFAULT = 6.77 FT] ? **(c/r)**

"User-Friendly" POT Model

ENTER INITIAL WATER ELEVATION FOR CONSERVATION AREA 3B
[DEFAULT = 7.36 FT] ? (c/r)

DO YOU WANT TO RE-INITIALIZE THE STAGE IN ANY AREA
EACH YEAR (<Y>ES OR <N>O [DEFAULT = NO]) ? y

ENTER MONTH AND DAY (MM,DD) TO RE-INITIALIZE STAGE ? 3,1

ENTER THE RE-INITIALIZED STAGE VALUE FOR LAKE OKEECHOBEE
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA]) ? (c/r)

ENTER THE RE-INITIALIZED STAGE VALUE FOR CONSERVATION AREA 1
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA]) ? (c/r)

ENTER THE RE-INITIALIZED STAGE VALUE FOR CONSERVATION AREA 2A
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA]) ? 11.5

ENTER THE RE-INITIALIZED STAGE VALUE FOR CONSERVATION AREA 3A
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA]) ? (c/r)

ENTER THE RE-INITIALIZED STAGE VALUE FOR CONSERVATION AREA 2B
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA]) ? (c/r)

ENTER THE RE-INITIALIZED STAGE VALUE FOR CONSERVATION AREA 3B
([DEFAULT = DO NOT RE-INITIALIZE THIS AREA]) ? (c/r)

ENTER THE FILE NAME OF THE "DEMANDS" INFORMATION
[DEFAULT = "ESTDMD" (ESTABLISHED DEMANDS)] ? (c/r)

ENTER THE FILE NAME OF THE "MODIFIED DELTA STORAGE"
DATA TO BE USED
[DEFAULT = "ESTMDS" (ESTABLISHED MOD. DELTA STORAGE)] ? (c/r)

SPECIAL EVENT INFORMATION (CHANGES TO HISTORICAL STORAGE)
ENTER "SPECIAL EVENT" INFORMATION FILE NAME
[DEFAULT = "NOEVENT" FILE] ? (c/r)

ENTER "OUTPUT" FILE NAME ? jusatst

* * * * *

"User-Friendly" POT Model

* * * * * U S E R S E L E C T I O N * * * * *

LISTED BELOW ARE THE SELECTIONS YOU MADE
IF THERE ARE ANY QUESTIONS OR PROBLEMS; YOU WILL
BE GIVEN AN OPPORTUNITY TO MAKE CORRECTIONS

AREA NAME	SCHEDULE STATUS	FILE NAME
-----	-----	-----
LAKE OKEECHOBEE	NEW	LAKETST
CONSERVATION AREA 1	ESTABLISHED	ESTCA1
CONSERVATION AREA 2A	ESTABLISHED	ESTCA2A
CONSERVATION AREA 3A	ESTABLISHED	ESTCA3A
CONSERVATION AREA 2B	ESTABLISHED	ESTCA2B
CONSERVATION AREA 3B	ESTABLISHED	ESTCA3B

IS THIS INFORMATION CORRECT <Y>ES OR <N>O ? ? **y**

ENTER USER ID NAME - ? **faraone**

STOP

--- SENDING ROUTING MODEL JOB TO CENTRAL SITE

--- ROUTING MODEL (NORMAL TERMINATION)

READY.

"User-Friendly" POT Model

JJJJJJJJ	UU	UU	SSSSSSSS	AAAAAAA	TTTTTTTTTT
JJJJJJJJ	UU	UU	SSSSSSSSSS	AAAAAAAAA	TTTTTTTTTT
JJ	UU	UU	SS S	AA AA	TT
JJ	UU	UU	SS	AA AA	TT
JJ	UU	UU	SSSSSSSS	AA AA	TT
JJ	UU	UU	SSSSSSSS	AAAAAAAAA	TT
JJ JJ	UU	UU	SS	AAAAAAAAA	TT
JJ JJ	UU	UU	S SS	AA AA	TT
JJJJJJJ	UUUUUUUUUU		SSSSSSSSSS	AA AA	TT
JJJJJ	UUUUUUUU		SSSSSSSS	AA AA	TT

Banner page generated by the system which contains the name given as the output file.

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

AREA NAME	- LAKE OKEECHOBEE		
FILE NAME	- LAKETST		
COMMENT	- JUST A TEST CASE		
NUMBER OF SCHEDULES (R,C)	- 1 1		
CA-1 FALL(1) DELSTG,DAYS,Q-	.25	10.00	.50
CA-1 RISE(1) DELSTG,DAYS,Q-	.20	5.00	.75
CA-2A FALL(1) DELSTG,DAYS,Q-	.20	5.00	.30
CA-2A RISE(1) DELSTG,DAYS,Q-	.25	4.00	.70
CA-3A FALL(1) DELSTG,DAYS,Q-	.30	5.00	.50
CA-3A RISE(1) DELSTG,DAYS,Q-	.25	3.00	.80
S-77 FALL(1) DELSTG,DAYS,Q-	.20	5.00	.50
S-77 RISE(1) DELSTG,DAYS,Q-	.25	5.00	.70
S-80 FALL(1) DELSTG,DAYS,Q-	.20	5.00	.30
S-80 RISE(1) DELSTG,DAYS,Q-	.30	5.00	.70
CUT-BACK PERCENTAGE	-	.80	
SUPPLY IMPOSSIBLE BELOW	-	10.30	
MAINTAIN STAGE (1=YES)	-	0	
ENP DEMANDS MET (1=YES)	-	0	
REG DISCHARGE DISCONTINUED	-	1	
REGULATORY SCHEDULE 1	-	1/ 1	16.50
REGULATORY SCHEDULE 1	-	3/ 1	15.50
REGULATORY SCHEDULE 1	-	6/ 1	15.50
REGULATORY SCHEDULE 1	-	9/15	16.50
CUT - BACK SCHEDULE 1	-	1/ 1	12.25
CUT - BACK SCHEDULE 1	-	3/31	11.50

Whenever a "newly" defined file is created; a file is replaced into the user's group account. It contains all the options selected.

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

AREA NAME	-	CONSERVATION AREA 1		
FILE NAME	-	ESTCA1		
COMMENT	-	THE CURRENT OPERATING SCHEDULE		
NUMBER OF SCHEDULES	-	1 1		
EAST FALL(1) DELSTG,DAYS,Q-		.00	1.00	1.00
EAST RISE(1) DELSTG,DAYS,Q-		.00	1.00	1.00
S-10 FALL(1) DELSTG,DAYS,Q-		.00	1.00	1.00
S-10 RISE(1) DELSTG,DAYS,Q-		.00	1.00	1.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
CUT-BACK PERCENTAGE	-	.80		
SUPPLY IMPOSSIBLE BELOW	-	10.50		
MAINTAIN STAGE (1=YES)	-	1		
ENP DEMANDS MET (1=YES)	-	0		
REG DISCHARGE DISCONTINUED	-	1		
REGULATORY SCHEDULE 1	-	1/ 1	17.00	
REGULATORY SCHEDULE 1	-	4/30	14.00	
REGULATORY SCHEDULE 1	-	6/30	14.00	
REGULATORY SCHEDULE 1	-	7/ 1	15.35	
REGULATORY SCHEDULE 1	-	8/12	15.35	
REGULATORY SCHEDULE 1	-	10/22	17.00	
CUT - BACK SCHEDULE 1	-	1/ 1	11.00	

Files that begin with the prefix "EST" indicate that the file is an "established" (current operating) file.

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

AREA NAME	-	CONSERVATION AREA 2A		
FILE NAME	-	ESTCA2A		
COMMENT	-	THE CURRENT OPERATING SCHEDULE		
NUMBER OF SCHEDULES	-	1 1		
EAST FALL(1) DELSTG,DAYS,Q-		.00	1.00	1.00
EAST RISE(1) DELSTG,DAYS,Q-		.00	1.00	1.00
S-11 FALL(1) DELSTG,DAYS,Q-		.00	1.00	1.00
S-11 RISE(1) DELSTG,DAYS,Q-		.00	1.00	1.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
CUT-BACK PERCENTAGE	-	.80		
SUPPLY IMPOSSIBLE BELOW	-	8.50		
MAINTAIN STAGE (1=YES)	-	1		
ENP DEMANDS MET (1=YES)	-	0		
REG DISCHARGE DISCONTINUED	-	1		
REGULATORY SCHEDULE 1	-	1/ 1	10.65	
REGULATORY SCHEDULE 1	-	3/12	9.50	
REGULATORY SCHEDULE 1	-	8/31	12.50	
CUT - BACK SCHEDULE 1	-	1/ 1	8.50	

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

AREA NAME	-	CONSERVATION AREA 3A
FILE NAME	-	ESTCA3A
COMMENT	-	THE CURRENT OPERATING SCHEDULE
NUMBER OF SCHEDULES	-	2 1
S-151 FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
S-151 RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
S-151 FALL(2) DELSTG,DAYS,Q-	.00	1.00 1.00
S-151 RISE(2) DELSTG,DAYS,Q-	.00	1.00 1.00
S-12 FALL(1) DELSTG,DAYS,Q-	.00	1.00 1.00
S-12 RISE(1) DELSTG,DAYS,Q-	.00	1.00 1.00
S-12 FALL(2) DELSTG,DAYS,Q-	.00	1.00 1.00
S-12 RISE(2) DELSTG,DAYS,Q-	.00	1.00 1.00
S-333 FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
S-333 RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
S-333 FALL(2) DELSTG,DAYS,Q-	.00	1.00 .00
S-333 RISE(2) DELSTG,DAYS,Q-	.00	1.00 .00
PADCV FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
PADCV RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
PADCV FALL(2) DELSTG,DAYS,Q-	.00	1.00 1.00
PADCV RISE(2) DELSTG,DAYS,Q-	.00	1.00 1.00
FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
FALL(2) DELSTG,DAYS,Q-	.00	1.00 .00
RISE(2) DELSTG,DAYS,Q-	.00	1.00 .00
CUT-BACK PERCENTAGE	-	.80
SUPPLY IMPOSSIBLE BELOW	-	7.50
MAINTAIN STAGE (1=YES)	-	1
ENP DEMANDS MET (1=YES)	-	1
REG DISCHARGE DISCONTINUED	-	2
REGULATORY SCHEDULE 1	-	1/ 1 5.50
REGULATORY SCHEDULE 2	-	1/ 1 10.50
REGULATORY SCHEDULE 2	-	5/31 9.50
REGULATORY SCHEDULE 2	-	10/31 10.50
CUT - BACK SCHEDULE 1	-	1/ 1 7.50

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

AREA NAME	-	CONSERVATION AREA 2B		
FILE NAME	-	ESTCA2B		
COMMENT	-	THE CURRENT OPERATING SCHEDULE		
NUMBER OF SCHEDULES	-	1 0		
FALL(1) DELSTG,DAYS,Q-		.00	1.00	1.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	1.00
EAST FALL(1) DELSTG,DAYS,Q-		.00	1.00	1.00
EAST RISE(1) DELSTG,DAYS,Q-		.00	1.00	1.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
FALL(1) DELSTG,DAYS,Q-		.00	1.00	.00
RISE(1) DELSTG,DAYS,Q-		.00	1.00	.00
CUT-BACK PERCENTAGE	-			
SUPPLY IMPOSSIBLE BELOW	-	8.50		
MAINTAIN STAGE (1=YES)	-	0		
ENP DEMANDS MET (1=YES)	-	0		
REG DISCHARGE DISCONTINUED	-	1		
REGULATORY SCHEDULE 1	-	1/ 1	10.50	

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

AREA NAME	-	CONSERVATION AREA 3B		
FILE NAME	-	ESTCA3B		
COMMENT	-	THE CURRENT OPERATING SCHEDULE		
NUMBER OF SCHEDULES	-	1 0		
		FALL(1) DELSTG,DAYS,Q-	.00	1.00 1.00
		RISE(1) DELSTG,DAYS,Q-	.00	1.00 1.00
EAST		FALL(1) DELSTG,DAYS,Q-	.00	1.00 1.00
EAST		RISE(1) DELSTG,DAYS,Q-	.00	1.00 1.00
		FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
		RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
		FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
		RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
		FALL(1) DELSTG,DAYS,Q-	.00	1.00 .00
		RISE(1) DELSTG,DAYS,Q-	.00	1.00 .00
CUT-BACK PERCENTAGE	-			
SUPPLY IMPOSSIBLE BELOW	-	8.50		
MAINTAIN STAGE (1=YES)	-	0		
ENP DEMANDS MET (1=YES)	-	0		
REG DISCHARGE DISCONTINUED	-	1		
REGULATORY SCHEDULE 1	-	1/ 1	9.50	

"User-Friendly" POT Model

*** USER - FRIENDLY ***
*** ROUTING - MODEL ***
DATE - 85/10/04. TIME - 13.32.10.

SPECIAL OPTIONS FILE - SPECIAL OPTIONS
FILE NAME - OPTIONS
COMMENT - THE CURRENT OPTION SELECTION
USER ACCOUNT ID. - FARAONE
INTERIM ACTION PLAN (1=YES)- 1
DATA PERIOD START END DATES- 01/01/63 06/30/83
SUPPLY DEMANDS FILE NAME - ESTDMD
MODIFIED DELTA STORAGE FILE- ESTMDS
SPECIAL EVENT - -1 NOEVENT 00/00/00
INITIAL STAGE VALUES - 15.25 15.72 12.00 8.80 6.77
RE-INITIALIZE STAGE VALUES - 3 1 99.99 99.99 11.50 99.99
NUMBER OF ADDITIONAL FLOWS - 0 0 0 0 0 0
LOKE ADDITIONAL FLOW INFO - 0 XXXXXXXX 0 XXXXXXXX
CA1 ADDITIONAL FLOW INFO - 0 XXXXXXXX 0 XXXXXXXX
CA2A ADDITIONAL FLOW INFO - 0 XXXXXXXX 0 XXXXXXXX
CA3A ADDITIONAL FLOW INFO - 0 XXXXXXXX 0 XXXXXXXX
CA2B ADDITIONAL FLOW INFO - 0 XXXXXXXX 0 XXXXXXXX
CA3B ADDITIONAL FLOW INFO - 0 XXXXXXXX 0 XXXXXXXX
S12 & S333(TMAC PLAN 1=YES)- 1

This file contains the "special" options that
affect the overall system.

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

DAILY REGULATION (REG) AND CUT-BACK (C-B) SCHEDULES FOR JANU

DATE	LOKE REG	LOKE C-B	CA1 REG	CA1 C-B	CA2A REG	CA2A C-B	CA3A REG	CA3A REG	
01/01	16.50	12.25	17.00	11.00	10.65	8.50	5.50	10.50	7
01/02	16.48	12.24	16.97	11.00	10.63	8.50	5.50	10.49	7
01/03	16.47	12.23	16.95	11.00	10.62	8.50	5.50	10.49	7
01/04	16.45	12.22	16.92	11.00	10.60	8.50	5.50	10.48	7
01/05	16.43	12.22	16.90	11.00	10.58	8.50	5.50	10.47	7
01/06	16.42	12.21	16.87	11.00	10.57	8.50	5.50	10.47	7
01/07	16.40	12.20	16.85	11.00	10.55	8.50	5.50	10.46	7
01/08	16.38	12.19	16.82	11.00	10.54	8.50	5.50	10.45	7
01/09	16.36	12.18	16.80	11.00	10.52	8.50	5.50	10.45	7
01/10	16.35	12.17	16.77	11.00	10.50	8.50	5.50	10.44	7
01/11	16.33	12.17	16.75	11.00	10.49	8.50	5.50	10.43	7
01/12	16.31	12.16	16.72	11.00	10.47	8.50	5.50	10.43	7
01/13	16.30	12.15	16.70	11.00	10.45	8.50	5.50	10.42	7
01/14	16.28	12.14	16.67	11.00	10.44	8.50	5.50	10.41	7
01/15	16.26	12.13	16.65	11.00	10.42	8.50	5.50	10.41	7
01/16	16.25	12.12	16.62	11.00	10.40	8.50	5.50	10.40	7
01/17	16.23	12.12	16.60	11.00	10.39	8.50	5.50	10.39	7
01/18	16.21	12.11	16.57	11.00	10.37	8.50	5.50	10.39	7
01/19	16.19	12.10	16.55	11.00	10.35	8.50	5.50	10.38	7
01/20	16.18	12.09	16.52	11.00	10.34	8.50	5.50	10.37	7
01/21	16.16	12.08	16.50	11.00	10.32	8.50	5.50	10.37	7
01/22	16.14	12.07	16.47	11.00	10.31	8.50	5.50	10.36	7
01/23	16.13	12.06	16.45	11.00	10.29	8.50	5.50	10.35	7
01/24	16.11	12.06	16.42	11.00	10.27	8.50	5.50	10.35	7
01/25	16.09	12.05	16.39	11.00	10.26	8.50	5.50	10.34	7
01/26	16.08	12.04	16.37	11.00	10.24	8.50	5.50	10.33	7
01/27	16.06	12.03	16.34	11.00	10.22	8.50	5.50	10.33	7
01/28	16.04	12.02	16.32	11.00	10.21	8.50	5.50	10.32	7
01/29	16.03	12.01	16.29	11.00	10.19	8.50	5.50	10.31	7
01/30	16.01	12.01	16.27	11.00	10.17	8.50	5.50	10.31	7
01/31	15.99	12.00	16.24	11.00	10.16	8.50	5.50	10.30	7

The next two pages show the results of the break-point data being distributed over time. A page would be created for each month.

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

DAILY REGULATION (REG) AND CUT-BACK (C-B) SCHEDULES FOR FEBR

DATE	LOKE REG	LOKE C-B	CA1 REG	CA1 C-B	CA2A REG	CA2A C-B	CA3A REG	CA3A REG	
02/01	15.97	11.99	16.22	11.00	10.14	8.50	5.50	10.29	7
02/02	15.96	11.98	16.19	11.00	10.12	8.50	5.50	10.29	7
02/03	15.94	11.97	16.17	11.00	10.11	8.50	5.50	10.28	7
02/04	15.92	11.96	16.14	11.00	10.09	8.50	5.50	10.27	7
02/05	15.91	11.96	16.12	11.00	10.08	8.50	5.50	10.27	7
02/06	15.89	11.95	16.09	11.00	10.06	8.50	5.50	10.26	7
02/07	15.87	11.94	16.07	11.00	10.04	8.50	5.50	10.25	7
02/08	15.86	11.93	16.04	11.00	10.03	8.50	5.50	10.25	7
02/09	15.84	11.92	16.02	11.00	10.01	8.50	5.50	10.24	7
02/10	15.82	11.91	15.99	11.00	9.99	8.50	5.50	10.23	7
02/11	15.81	11.90	15.97	11.00	9.98	8.50	5.50	10.23	7
02/12	15.79	11.90	15.94	11.00	9.96	8.50	5.50	10.22	7
02/13	15.77	11.89	15.92	11.00	9.94	8.50	5.50	10.21	7
02/14	15.75	11.88	15.89	11.00	9.93	8.50	5.50	10.21	7
02/15	15.74	11.87	15.87	11.00	9.91	8.50	5.50	10.20	7
02/16	15.72	11.86	15.84	11.00	9.89	8.50	5.50	10.19	7
02/17	15.70	11.85	15.82	11.00	9.88	8.50	5.50	10.19	7
02/18	15.69	11.85	15.79	11.00	9.86	8.50	5.50	10.18	7
02/19	15.67	11.84	15.76	11.00	9.85	8.50	5.50	10.17	7
02/20	15.65	11.83	15.74	11.00	9.83	8.50	5.50	10.17	7
02/21	15.64	11.82	15.71	11.00	9.81	8.50	5.50	10.16	7
02/22	15.62	11.81	15.69	11.00	9.80	8.50	5.50	10.15	7
02/23	15.60	11.80	15.66	11.00	9.78	8.50	5.50	10.15	7
02/24	15.58	11.79	15.64	11.00	9.76	8.50	5.50	10.14	7
02/25	15.57	11.79	15.61	11.00	9.75	8.50	5.50	10.13	7
02/26	15.55	11.78	15.59	11.00	9.73	8.50	5.50	10.13	7
02/27	15.53	11.77	15.56	11.00	9.71	8.50	5.50	10.12	7
02/28	15.52	11.76	15.54	11.00	9.70	8.50	5.50	10.11	7

"User-Friendly" POT Model

*** USER - FRIENDLY ***
 *** ROUTING - MODEL ***
 DATE - 85/10/04. TIME - 13.32.10.

DATA ANALYSIS PERIOD

START DATE (MM/YY) - 01/63

END DATE (MM/YY) - 06/83

INITIAL WATER ELEVATION

LOKE = 15.25 CA1 = 15.72 CA2A = 12.00
 CA3A = 8.80 CA2B = 6.77 CA3B = 7.36

THE NUMBER OF REGULATION LINES ON EACH SCHEDULE

LOKE = 1 CA1 = 1 CA2A = 1
 CA3A = 2 CA2B = 1 CA3B = 1

THE DISCHARGE THROUGH AN AREA AND STRUCTURE [DS=DELTA STAGE(FT), ND=N

AREA	STR	!-- FALLING --!!--			RISING ---!!--			FALLING --!!--			RISING -		
		DS	ND	DISCHG	DS	ND	DISCHG	DS	ND	DISCHG	DS	ND	DISC
LOKECA-1		.25	10.	1.	.20	5.	1.						
LOKECA-2A		.20	5.	0.	.25	4.	1.						
LOKECA-3A		.30	5.	1.	.25	3.	1.						
LOKES-77		.20	5.	1.	.25	5.	1.						
LOKES-80		.20	5.	0.	.30	5.	1.						
CA1EAST		.00	1.	1.	.00	1.	1.						
CA1S-10		.00	1.	1.	.00	1.	1.						
CA1		.00	1.	0.	.00	1.	0.						
CA1		.00	1.	0.	.00	1.	0.						
CA1		.00	1.	0.	.00	1.	0.						
CA2AEAST		.00	1.	1.	.00	1.	1.						
CA2AS-11		.00	1.	1.	.00	1.	1.						
CA2A		.00	1.	0.	.00	1.	0.						
CA2A		.00	1.	0.	.00	1.	0.						
CA2A		.00	1.	0.	.00	1.	0.						
CA3AS-151		.00	1.	0.	.00	1.	0.	.00	1.	1.	.00	1.	
CA3AS-12		.00	1.	1.	.00	1.	1.	.00	1.	1.	.00	1.	
CA3AS-333		.00	1.	0.	.00	1.	0.	.00	1.	0.	.00	1.	
CA3APADCV		.00	1.	0.	.00	1.	0.	.00	1.	1.	.00	1.	
CA3A		.00	1.	0.	.00	1.	0.	.00	1.	0.	.00	1.	
CA2BEAST		.00	1.	1.	.00	1.	1.						
CA2B		.00	1.	1.	.00	1.	1.						
CA2B		.00	1.	0.	.00	1.	0.						
CA2B		.00	1.	0.	.00	1.	0.						
CA2B		.00	1.	0.	.00	1.	0.						
CA3BEAST		.00	1.	1.	.00	1.	1.						
CA3B		.00	1.	1.	.00	1.	1.						
CA3B		.00	1.	0.	.00	1.	0.						
CA3B		.00	1.	0.	.00	1.	0.						
CA3B		.00	1.	0.	.00	1.	0.						

"User-Friendly" POT Model

*** USER - FRIENDLY ***
*** ROUTING - MODEL ***
DATE - 85/10/04. TIME - 13.32.10.

ENP MINIMUM DEMANDS TO BE MET (1=YES, 0=NO)

ENP = 1

NUMBER OF ADDITIONAL FLOWS

LOKE = 0 CA1 = 0 CA2A = 0
CA3A = 0 CA2B = 0 CA3B = 0

IS IT ALWAYS ADDED TO STORAGE

RECORD = 0 0 0 0 0 0 0 0 0 0 0 0

NUMBER OF CUT-BACKS AND THEIR PERCENTAGES

LOKE CB# = 1	PERCENTAGES =	.80	.00	.00	.00
CA1 CB# = 1	PERCENTAGES =	.80	.00	.00	.00
CA2A CB# = 1	PERCENTAGES =	.80	.00	.00	.00
CA3A CB# = 1	PERCENTAGES =	.80	.00	.00	.00
CA2B CB# = 0	PERCENTAGES =	.00	.00	.00	.00
CA3B CB# = 0	PERCENTAGES =	.00	.00	.00	.00

ELEVATIONS AT WHICH WATER SUPPLY IS IMPOSSIBLE

LOKE = 10.30	CA1 = 10.50	CA2A = 8.50
CA3A = 7.50	CA2B = 8.50	CA3B = 8.50

IF WATER IS AVAILABLE - MAINTAIN STAGES (1=YES)

CA1 = 1 CA2A = 1 CA3A = 1
CA2B = 0 CA3B = 0

INTERIM-ACTION PLAN "IAP" IN EFFECT (1=YES)

IAP = 1

REGULATORY DISCHARGE DISCONTINUED AT

CA1 = 1 CA2A = 1 CA3A = 2

INITIALIZE DATE AND STAGE VALUES

DATE -- MONTH = 3 DAY = 1
LOKE = 99.99 CA1 = 99.99 CA2A = 11.50
CA3A = 99.99 CA2B = 99.99 CA3B = 99.99

S-12 AND S-333 TO BE OPERATED UNDER THE
"RAINFALL DRIVEN" PLAN (1 = YES)

MACPLAN = 1

"User-Friendly" POT Model

A B S T R A C T

The "user-friendly" POT Model documentation presented in the previous section is only a part of the overall system of programs that evolve around the decisions that are made to investigate other alternatives in operating the system.

Due to the vast amount of output generated by the "POT" model a series of programs were developed to assist in the analysis of the data and they are as follows:

- BARPLOT** - A graphical representation (bar-chart) of two "POT" model output files for the "summed" monthly discharge of a particular structure
- STGFLT** - A graphical representation (line) of the stage elevations for any area. It has the capability of comparing the output of five (5) "POT" model output files
- WATBUD** - Computes either a daily, weekly, monthly or yearly water budgets for one or all areas for one (1) "POT" model output
- SDSF** - A graphical representation (line) of the "Stage-Duration and Stage-Frequency" for one or all areas for one (1) "POT" model output. There is also a printed analysis.

The following pages will describe the required input for each of these programs and sample sessions. It was the intention of the author of these programs to utilize existing programs whenever possible and to utilize features of the Control Data Corporation computer "Cyber" such as "inter-active" procedure files. BARPLOT is the only program of this series that uses a Fortran program to issue the questions; the others are generated by an "inter-active" procedure.

"User-Friendly" POT Model

"POT" Model Programs

=====

SDSF

Generates a Stage-Duration
Stage-Frequency plots for
each area

WATBUD

Computes Daily, Weekly
Monthly and Yearly
Water Budgets for each
area.

POT

Generates Computed
Results Based upon
User Options

=====

= O U T P U T =

=====

STGPLOT

Plots daily stage plots
for each area. It can
compare results of up to
four "POT" output files
on one plot output.

BARPLT

Plots the summed monthly
discharge of a particular
structure and shows a
comparison between two
"POT" output files.

"User-Friendly" POT Model

B A R P L O T

Purpose:

This program is designed to generate a "job stream" (Cyber control cards) necessary to compare the results of two (2) "POT" model output files for a "Summed Monthly Discharge" in a graphical representation (bar-chart) for one (1) or more areas for a particular discharge structure.

Input Description:

ENTER YOUR USER GROUP ID

The name of your Cyber user group name

OUTPUT FILE NUMBER 1

ENTER OUTPUT FILENAME FROM UF-POT

The name of the first "user-friendly" POT model output to be compared

ENTER USER GROUP NAME WHERE THE FILE EXISTS

IF IT IS "....." THEN PRESS CARRIAGE RETURN

Where - .. is the user group id name entered early

Enter the user group where the file exists

ENTER UP TO A 70 CHARACTER LABEL FOR FILE

(DEFAULT=NO LABEL)

LABEL-

The Cyber converts lowercase letters to uppercase letters

OUTPUT FILE NUMBER 2

ENTER OUTPUT FILENAME FROM UF-POT

The name of the second "user-friendly" POT model output to be compared

"User-Friendly" POT Model

**ENTER USER GROUP NAME WHERE THE FILE EXISTS
IF IT IS "....." THEN PRESS CARRIAGE RETURN**

Where - .. is the user group id name entered early

Enter the user group where the file exists

**ENTER UP TO A 70 CHARACTER LABEL FOR FILE
(DEFAULT=NO LABEL)
LABEL-**

The Cyber converts lowercase letters to uppercase letters

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES FROM LAKE OKKECHOBEE TO

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 1 - LAKE SERVICE AREAS
- 2 - CONSERVATION AREA 1
- 3 - CONSERVATION AREA 2A
- 4 - CONSERVATION AREA 3A
- 5 - ST. LUCIE (S-308)
- 6 - S-77

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES TO LAKE OKKECHOBEE

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 7 - BACKPUMPING FROM HILLSBORO
- 8 - BACKPUMPING FROM N.N.R.
- 9 - BACKPUMPING FROM MIAMI

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES FOR

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 10 - S-80

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES FROM WCA 1 TO

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 14 - LOWER EAST COAST S.A. 1
- 15 - S-10

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES FROM WCA 2A TO

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 17 - LOWER EAST COAST S.A. 2
- 18 - S-11

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES FROM WCA 3A TO

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 20 - S-151
- 21 - S-12
- 22 - S-333
- 23 - PADRICK CULVERT

SELECT ONE (0, 1-6, 7-9, 10, 14-15, 17-18, 20 - 23) -

"User-Friendly" POT Model

ENTER MAIN TITLE FOR THIS PLOT (80 CHARACTERS MAXIMUM)
DEFAULT = " A BLANK LINE"

ENTER Y-AXIS TITLE
DEFAULT = "DISCHARGE (ACRE FEET * 1000)"

SELECT SCALING FACTOR
ALL DATA VALUES ARE DIVIDED BY THE SCALING FACTOR
DEFAULT = 1000

ENTER THE Y-AXIS MINIMUM VALUE
DEFAULT = 0 (ZERO)

ENTER INCREMENTAL VALUE BETWEEN TICKS
DEFAULT = 50

ENTER YOUR PASSWORD (FOR THE LOG-ON)
DEFAULT =

Where - .. is the user group id

ENTER THE DIVISION NUMBER COMMA PROJECT NUMBER
I.E. 304,3004

"User-Friendly" POT Model

-,barplot

```
*****
*                                     *
*           U S E R - F R I E N D L Y           *
*                                     *
*           S U M M E D   M O N T H L Y           *
*                                     *
*           D I S C H A R G E   P L O T T I N G   *
*                                     *
*                               P R O G R A M       *
*                                     *
*****
```

WELCOME TO USER-FRIENDLY DISCHARGE PLOTTING PROGRAM

ENTER YOUR USER GROUP ID ? **faraone**

OUTPUT FILE NUMBER 1

ENTER OUTPUT FILENAME FROM UF-POT ? **july1**

ENTER USER GROUP NAME WHERE THE FILE EXISTS

IF IT IS "FARAONE" THEN PRESS CARRIAGE RETURN ? **azeredo**

ENTER UP TO A 70 CHARACTER LABEL FOR FILE NAME "JULY1 "
(DEFAULT=NO LABEL)

LABEL-? **Initialized July 1**

OUTPUT FILE NUMBER 2

ENTER OUTPUT FILENAME FROM UF-POT ? **xxx**

ENTER USER GROUP NAME WHERE THE FILE EXISTS

IF IT IS "FARAONE" THEN PRESS CARRIAGE RETURN ? **azeredo**

ENTER UP TO A 70 CHARACTER LABEL FOR FILE NAME "XXX "
(DEFAULT=NO LABEL)

LABEL-? **I didn't know another name**

"User-Friendly" POT Model

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES FROM
LAKE OKEECHOBEE TO

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 1 - LAKE SERVICE AREAS
- 2 - CONSERVATION AREA 1
- 3 - CONSERVATION AREA 2A
- 4 - CONSERVATION AREA 3A
- 5 - ST. LUCIE (S-308)
- 6 - S-77

SELECT ONE (0, 1 - 6) - ? 0

WOULD YOU LIKE TO PLOT MONTHLY DISCHARGES TO LAKE OKEECHOBEE

- 0 - SKIP TO NEXT SECTION (DEFAULT=CARRIAGE RETURN)
- 7 - BACKPUMPING FROM HILLSBORO
- 8 - BACKPUMPING FROM N.N.R.
- 9 - BACKPUMPING FROM MIAMI

SELECT ONE (0, 7 - 9) - ? 9

ENTER MAIN TITLE FOR THIS PLOT (80 CHARACTERS MAXIMUM)
DEFAULT = " A BLANK LINE"

? Monthly Discharges

ENTER Y-AXIS TITLE
DEFAULT = "DISCHARGE (ACRE FEET * 1000)"

?

SELECT SCALING FACTOR
ALL DATA VALUES ARE DIVIDED BY THE SCALING FACTOR
DEFAULT = 1000

?

ENTER THE Y-AXIS MINIMUM VALUE
DEFAULT = 0 (ZERO)

?

ENTER INCREMENTAL VALUE BETWEEN TICKS
DEFAULT = 50

?

ENTER THE YOUR PASSWORD (FOR THE LOG-ON)
DEFAULT = FARAONE

? vince

ENTER THE DIVISION NUMBER COMMA PROJECT NUMBER
IE. 304,3004 ? 304,3004

STOP

--- ROUTING "PLOT MONTHLY DISCHARGE" TO THE CENTRAL SITE
READY.

"User-Friendly" POT Model

S T G P L O T

Purpose:

The program is designed to generate a "job stream" (Cyber control cards) necessary to plot for comparison the results of stage elevations of up to five (5) "POT" model output files for one or more areas.

Input Description:

HOW MANY FILES ARE YOU GOING TO PLOT (1-5)

Enter the number of files you are going to compare

IS THIS A "HOLEYLAND" RUN <Y>ES OR <N>O

The answer is typically "N"

ENTER PLOT TYPE ([1, 2, 3])

- Where - 1) LONG - Simulation Analysis (Period of Record)
(A 21 year plot is 12" by 60" long)
2) SHORT - Report Size (3 Years/Plot)
(An 8.5" by 11")
3) OWN - Analysis less than the Period of Record

ENTER YOUR USER ID

Enter you user group id

PLOT STAGES FOR LAKE OKKECHOBEE <Y>ES OR <N>O

CONSERVATION AREA 1 <Y>ES OR <N>O
CONSERVATION AREA 2A <Y>ES OR <N>O
CONSERVATION AREA 3A <Y>ES OR <N>O
CONSERVATION AREA 2B <Y>ES OR <N>O
CONSERVATION AREA 3B <Y>ES OR <N>O

Enter a "Y" or "N" after each area name to determine whether plots are required or not

"User-Friendly" POT Model

ENTER OUTPUT FILE NAME FROM UF-POT

Enter the "POT" model output file

ENTER LABEL FOR -

Enter a label for the file name specified above

**ENTER USER GROUP NAME WHERE THE FILE EXISTS
IF IT IS "....." THEN PRESS RETURN**

Enter the location (user group id) where the file name exists

***** NOTE *****

The "enter output file name", "enter label" and "enter user group" will be repeated the number of times specified in "how many files"

ENTER MAIN PLOT TITLE -

Enter the main title of the plot, 80 characters maximum.

**ENTER PASSWORD (FOR LOG ON)
IF IT IS "....." THEN PRESS "RETURN"**

Enter the Cyber "log-on" password

ENTER CHARGE NUMBER - DIVISION, PROJECT (#,##)

"User-Friendly" POT Model

-stageplot,uf

```
*****
*
*           U S E R - F R I E N D L Y
*
*           S T A G E   P L O T T I N G
*
*           P R O G R A M
*
*****
```

--- COMPILING "PLOT STAGE" PROGRAM

WELCOME TO USER-FRIENDLY PLOTTING PROGRAM

=====

HOW MANY FILES ARE YOU GOING TO PLOT (1-5) ? 2

IS THIS A "HOLEYLAND" RUN <Y>ES OR <N>O ? n

TYPE OF PLOTS -

- 1) LONG - SIMULATION ANALYSIS (PERIOD OF RECORD)
- 2) SHORT - REPORT SIZE (3 YEARS/PLOT)
- 3) OWN - ANALYSIS LESS THAN THE PERIOD OF RECORD

ENTER PLOT TYPE ([1, 2, 3]) ? 1

ENTER YOUR USER ID ? faraone

PLOT STAGES FOR LAKE OKEECHOBEE <Y>ES OR <N>O ?
ERROR (5) - YES OR NO RESPONSE NEEDED
VALID RESPONSE ARE [Y OR N]

PLOT STAGES FOR LAKE OKEECHOBEE <Y>ES OR <N>O ? y

PLOT STAGES FOR CONSERVATION AREA 1 <Y>ES OR <N>O ? n

PLOT STAGES FOR CONSERVATION AREA 2A <Y>ES OR <N>O ? n

PLOT STAGES FOR CONSERVATION AREA 3A <Y>ES OR <N>O ? y

PLOT STAGES FOR CONSERVATION AREA 2B <Y>ES OR <N>O ? n

PLOT STAGES FOR CONSERVATION AREA 3B <Y>ES OR <N>O ? n

***** FILE NUMBER 1 *****

ENTER OUTPUT FILE NAME FROM UF-POT ? july1

"User-Friendly" POT Model

ENTER LABEL FOR JULY1 -? Initialized July 1

**ENTER USER GROUP NAME WHERE THE FILE EXISTS
IF IT IS "FARAONE" THEN PRESS RETURN ? azeredo**

******* FILE NUMBER 2 *******

ENTER OUTPUT FILE NAME FROM UF-POT ? xxx

ENTER LABEL FOR XXX -? xxx

**ENTER USER GROUP NAME WHERE THE FILE EXISTS
IF IT IS "FARAONE" THEN PRESS RETURN ? azeredo**

ENTER MAIN PLOT TITLE - ? Comparison between July1 and xxx

**ENTER PASSWORD (FOR LOG ON)
IF IT IS "FARAONE" THEN PRESS "RETURN" ? vince**

**ENTER CHARGE NUMBER - DIVISION, PROJECT (#,##)? 304,3004
STOP**

--- ROUTING "PLOT STAGE" TO THE CENTRAL SITE

READY.

"User-Friendly" POT Model

-sdsf,ufproc

STAGE DURATION - STAGE FREQUENCY

Enter YG	= YOUR GROUP (YOUR ACCOUNT ID)	? faraone
Enter FN	= FILE NAME ('POT' MODEL OUTPUT)	? july1
Enter UG	= USER GROUP (FILE NAME LOCATION)	? azeredo
Enter YS	= YEAR START (YS=63)	? ys
Enter YE	= YEAR END (YE=83)	? ye
Enter LK	= COMPUTE FOR LAKE OKEECHOBEE (Y/N)	? n
Enter C1	= COMPUTE FOR CONS. AREA 1 (Y/N)	? y
Enter C2	= COMPUTE FOR CONS. AREA 2A (Y/N)	? n
Enter C3	= COMPUTE FOR CONS. AREA 3A (Y/N)	? n
Enter D	= PLOT DURATION (Y/N)	? y
Enter C	= PLOT MAX,MIN,MEAN CHARTS (Y/N)	? y
Enter TL	= MAIN TITLE OF PLOTS	? Another Test

YOU HAVE SELECTED THE FOLLOWING :

YOUR GROUP	= FARAONE
FILE NAME	= JULY1
USER GROUP	= AZEREDO
YEAR START	= 63
YEAR END	= 83
LAKE OKEE	= N
CONS. AREA 1A	= Y
CONS. AREA 2A	= N
CONS. AREA 3A	= N
DURATION	= 2
MAX,MIN,MEAN	= 1
TITLE	= ANOTHERTEST

--- GENERATING STAGE-DURATION/STAGE-FREQUENCY JOB STREAM

--- JOB STREAM ROUTED TO CENTRAL SITE

READY.

"User-Friendly" POT Model

-.watbud

'POT' MODEL WATER BUDGET CALCULATOR

Enter FN	=	FILE NAME ('POT' MODEL OUTPUT)	?	july1
Enter UG	=	USER GROUP (FILE NAME LOCATION)	?	azeredo
Enter LK	=	WATER BUDGET FOR LAKE OKEECHOBEE (Y/N)	?	n
Enter C1	=	WATER BUDGET FOR CONSERVATION AREA 1 (Y/N)?	y	
Enter C2	=	WATER BUDGET FOR CONSERVATION AREA 2A (Y/N)?	y	
Enter C3	=	WATER BUDGET FOR CONSERVATION AREA 3A (Y/N)?	n	
Enter FR	=	FREQUENCY REPORTING (D, W, M, Q, Y)	?	m
Enter OF	=	WATER BUDGET OUTPUT FILE NAME	?	july1out
Correct OF	=	WATER BUDGET OUTPUT FILE NAME	?	julyout

YOU HAVE SELECTED THE FOLLOWING :

THE FILE NAME IS CALLED JULY1
AND IT LOCATED IN USER GROUP AZEREDO

AND YOU WANT WATER BUDGETS FOR
CONSERVATION AREA 1
CONSERVATION AREA 2A

AND YOU WANT THEM COMPUTED
MONTHLY

AND STORE THE RESULTS IN FILE
JULYOUT

COPYING FILES

--- COMPILING "WATER BUDGET" PROGRAM

EXECUTING "WATER BUDGET" PROGRAM

STOP

READY.

APPENDIX 3

PROGRAM SPWEB

LAKE OKEECHOBEE AND LOWER EAST COAST ROUTING MODEL

MAJOR VARIABLES

NYEAR - NUMBER OF YEARS MODEL RUNS
 MON - MONTH OF THE YEAR
 NDAY - NUMBER OF IDAY IN A MONTH
 IDAY - DAY OF THE MONTH
 SWRC (A , B) - SURFACE WATER RELEASE FROM THE CONSERVATION AREAS
 QMXX (A , B) - MAX POSSIBLE RELEASE FROM THE CONSERVATION AREAS
 A - INDICATES WHICH CONSERVATION AREA
 B - INDICATES WHETHER RELEASE ARE MADE
 TO THE EAST OR TO THE SOUTH
 SWRL (C) - SURFACE WATER RELEASES FROM LAKE OKEECHOBEE
 QMAX (C) - MAX POSSIBLE RELEASE THROUGH STRUCTURE
 C - INDICATES LOCATION OF RELEASE
 STG (D) - STAGE (FT)
 STO (D) - STORAGE (AF)
 RGSTG (D) - REGULATION STAGE (FT)
 RGSTG (D) - REGULATION STORAGE
 DMND (D) - SERVICE AREA DEMAND
 GWR (D) - GROUNDWATER RELEASE FROM SERVICE AREAS
 XSTG (D , N) - VARIABLES CONTAIN STAGE-STORAGE BREAKPOINT
 XSTG (D , N) - CURVE FOR EACH AREA
 D - INDICATES AREA
 N - INDICATES NUMBER OF BREAKPOINTS

DIMENSION NUMD (12) , S12MIN(12)
 COMMON SWRC (3 , 2) , QMXX (3 , 2) , SWRL (6) ,
 + QMAX (6) , STO (9) , RGSTG (4) , RGSTG (4) ,
 + S12MIN(4) , XSTG (9 , 31) , XSTG (9 , 31) , N (3) ,
 + IDAY , PKMET , SP (12) , GWR (4) ,
 + ISW , IE , LO , ICA1 ,
 + ICA2 , ICA3 , ICA2B , ICA3B ,
 + ISA1 , ISA2 , ISA3 , NYEAR ,
 + IYEAR , MON , NDAY , ISTL ,
 + ICAR , MM (9) , STG (9) , PKDM ,
 + MA (7) , XAREA (7 , 10) , XAS (7 , 10)

COMMON / QMAX / QMAX (3 , 10) , SLIM (3 , 10)
 COMMON / CMDM / DMND (4)

DATA S12MIN / 25730. , 10930. , 4680. , 2030. , 2030. , 6040. , 8990. , 14840. ,
 + 47190. , 81140. , 71140. , 38820. /

DATA NUMD / 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31 /

C**** READ TIME INVARIANT DATA

CALL INIDATA

C**** DETERMINE THE YEAR AND MONTH AND DAY

DO 601 IYEAR = 1 , NYEAR

```

DO 600 MON = 1 , 12
NDAY = NUMD ( MON )
PKDM = S12MIN ( MON )
PKMET = 0.
DO 599 IDAY = 1 , NDAY
C
C**** ADD IN THE EFFECTS OF RF , ET , SEEPAGE AND PREDETERMINED FLOWS
C
CALL STATE
C
C**** DETERMINE MAXIMUM FLOW RATES THROUGH MAJOR DISCHARGE STRUCTURES
C
CALL TNSMX
C
C**** CALCULATE RELEASES MADE TO MEET DEMANDS
C
CALL DELIV
C
C**** CALCULATE REGULATORY RELEASES FROM LAKE OKEECHOBEE
C
CALL REGLO
C
C**** CALCULATE REGULATORY RELEASES FROM THE WATER CONSERVATION AREAS
C
CALL REGCA
C
C**** PRINT OUT MONTHLY DISCHARGES AND MONTH-END STAGES
C
CALL PRINT(INTYEAR)
C
599 CONTINUE
IF(IYEAR.EQ.19.AND.MON.EQ.8)STOP
C
600 CONTINUE
601 CONTINUE
STOP
END
SUBROUTINE STATE
C
DIMENSION DEL ( 9 ) , STOMAX ( 3 ) , SPOMAX ( 3 ) , SPOMIN ( 3 )
, ETR ( 7 ) , HAREA ( 7 ) , HSTG ( 7 )
C
COMMON SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
+ QMXL ( 6 ) , STO ( 9 ) , RGSTO ( 4 ) , RGSTG ( 4 ) ,
+ STOMIN ( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICA4 , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , XAREA ( 7 , 10 ) , XAS ( 7 , 10 )
C
DATA STOMAX /117360. , 86400. , 240000. /
DATA SPOMAX / 217.6 , 183.1 , 444.4 /
DATA SPOMIN / 90.1 , 58.6 , 83.6 /
C
C**** READ DAILY PREDETERMINED CHANGE IN STORAGE AND REGULATION SCHEDULE
C
READ (1,210) (DEL(I),I=LO,ISA3)
210 FORMAT(9F10.0,4F6.2)
READ(24,211)(RGSTG(I),I=LO,ICA3)
211 FORMAT(9X,F6.2,6X,F6.2,6X,F6.2,6X,F6.2)

```

```

      CALL CTOSTO ( LO , ICA3 , RGSTG , RGSTO )
C
C**** CONVERT STORAGE TO STAGE
C
      CALL CTOSTG
      IF (IDAY.EQ.1.AND.MON.EQ.1)REWIND 3
C
C*** READ IN HISTORICAL STAGES AND ET FOR LAKE AND WCAS
C
      READ( 3,93)ETLO,ETC
93    FORMAT (10X,F5.2,15X,F5.2)
      READ( 4,444)(HSTG(IAR),IAR=LO,ICA3B)
444   FORMAT(5(F5.2,1X))
C
C**** DETERMINE ET ADJUSTMENT (CF) FOR LAKE AND WCAS DUE TO DIFFERENCE
C**** IN SIMULATED STAGES AS COMPARED TO HISTORICAL STAGES
C
      DO 380 IAR = LO , ICA3
      DO 381 IT = 2 , MA(IAR)
        IF(HSTG(IAR)-XAS(IAR,IT))383,383,381
381    CONTINUE
383    HAREA(IAR)=XAREA(IAR,IT-1)+(HSTG(IAR)-XAS(IAR,IT-1))/(XAS(IAR,
+IT)-XAS(IAR,IT-1))*(XAREA(IAR,IT)-XAREA(IAR,IT-1))
380    CONTINUE
      DO 399 IAR=LO,ICA3
      ETR(IAR)=1
      MAA=MA(IAR)
      DO 397 IT=2,MAA
        IF(STG(IAR)-XAS(IAR,IT))398,398,397
397    CONTINUE
398    SUF=XAREA(IAR,IT-1)+(STG(IAR)-XAS(IAR,IT-1))/(XAS(IAR,
+IT)-XAS(IAR,IT-1))*(XAREA(IAR,IT)-XAREA(IAR,IT-1))
      ETR(IAR)=SUF/HAREA(IAR)
399    CONTINUE
C
C**** ADD THE EFFECTS OF RF - ET PLUS OTHER PREDETERMINED FLOWS
C      TO THE APPROPRIATE RESERVOIRS
C
      DO 20 IAR = LO , ISA3
      CF=0
      ET =ETC
      IF(IAR.GT.ICA3B)GO TO 17
      IF(IAR.EQ.LO)ET = ETLO
      CF=ET/12.*(1.-ETR(IAR))*HAREA(IAR)
17    STO( IAR ) = STO( IAR ) + DEL( IAR ) + CF
      IF ( STO ( IAR ) .LT. 0.0 ) STO ( IAR ) = 0.0
20    CONTINUE
C
C**** CALCULATE SEEPAGE FROM 'A' TO 'B' WITH FUNCTION SEEP ( A , B , C )
C
      SP( 1 ) = SEEP( ICA1 , ISA1 , 1 )
      SP( 2 ) = SEEP( ICA2 , ISA2 , 2 )
      SP( 3 ) = SEEP( ICA2 , ICA2B , 3 )
      SP( 4 ) = SEEP( ICA2B , ISA2 , 4 )
      SP( 5 ) = SEEP( ICA3 , ICA3B , 5 )
      SP( 6 ) = SEEP( ICA2 , ISA1 , 6 )
      SP( 7 ) = SEEP( ICA3 , ISA2 , 7 )
      SP( 8 ) = SEEP( ICA3B , ISA2 , 8 )
      SP( 9 ) = SEEP( ICA3B , ISA3 , 9 )
C
C**** CALCULATE SEEPAGE FROM SERVICE AREAS 1,2,3 TO THE OCEAN RESPECTIVELY
C
      SP ( 10 ) = SPOMIN ( 1 ) + ( SPOMAX ( 1 )-SPOMIN ( 1 ))*STO( ISA1 )
      +/ STOMAX ( 1 )

```

```

      SP ( 11 ) = SPOMIN ( 2 ) + ( SPOMAX ( 2 ) - SPOMIN ( 2 ) ) * STO ( ISA2 )
      STOMAX ( 2 )
      SP ( 12 ) = SPOMIN ( 3 ) + ( SPOMAX ( 3 ) - SPOMIN ( 3 ) ) * STO ( ISA3 )
      STOMAX ( 3 )
C
C**** ADD OR SUBTRACT SEEPAGE FROM THE APPROPRIATE STORAGE RESEVOIR
C
      STO ( ICA1 ) = STO ( ICA1 ) - SP ( 1 )
      STO ( ICA2 ) = STO ( ICA2 ) - SP ( 3 ) - SP ( 6 ) - SP ( 2 )
      STO ( ICA3 ) = STO ( ICA3 ) - SP ( 5 ) - SP ( 7 )
      STO ( ICA2B ) = STO ( ICA2B ) + SP ( 3 ) - SP ( 4 )
      STO ( ICA3B ) = STO ( ICA3B ) + SP ( 5 ) - SP ( 9 ) - SP ( 8 )
      STO ( ISA1 ) = STO ( ISA1 ) + SP ( 1 ) + SP ( 6 ) - SP ( 10 )
      STO ( ISA2 ) = STO ( ISA2 ) + SP ( 4 ) + SP ( 2 ) + SP ( 7 ) - SP ( 11 )
      STO ( ISA3 ) = STO ( ISA3 ) + SP ( 9 ) - SP ( 12 )
C
C**** WATER AMOUNTS GREATER THAN SERVICE AREA STORAGE ASSUMED TO
C      BE LOST TO RUNOFF INTO THE OCEAN
C
      IF ( STO ( ISA1 ) .GT. STOMAX ( 1 ) ) STO ( ISA1 ) = STOMAX ( 1 )
      IF ( STO ( ISA2 ) .GT. STOMAX ( 2 ) ) STO ( ISA2 ) = STOMAX ( 2 )
      IF ( STO ( ISA3 ) .GT. STOMAX ( 3 ) ) STO ( ISA3 ) = STOMAX ( 3 )
C
C**** INITIALIZE ALL DISCHARGES TO ZERO
C
      DO 50 I = LO , ICAR
50    SWRL ( I ) = 0.0
      DO 80 IC = ICA1 , ICA3
      I = IC - 1
      SWRC ( I , IE ) = 0.0
80    SWRC ( I , ISW ) = 0.0
      RETURN
      END
      SUBROUTINE PRINT ( INTYEAR )
C
      COMMON      SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
- QMXL ( 6 ) , STO ( 9 ) , RGSTO ( 4 ) , RGSTG ( 4 ) ,
- STOMIN ( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , XAREA ( 7 , 10 ) , XAS ( 7 , 10 )
      COMMON / CDMD / DMND ( 4 )
C
      DIMENSION SWRLS ( 6 ) , SWRCS ( 3 ) , SWRCE ( 3 ) , SPS ( 9 )
+ , DMOMT ( 4 ) , DMNDS ( 4 )
C
C**** SUM DAILY LAKE OKEECHOBEE OUTFLOWS OVER INDICATED PERIOD
C
      DO 1 I = 1 , 6
1    SWRLS ( I ) = SWRLS ( I ) + SWRL ( I )
C
C**** SUM DAILY WCAS OUTFLOWS
C
      DO 2 IAR = ICA1 , ICA3
      IA = IAR - 1
      SWRCS ( IA ) = SWRCS ( IA ) + SWRC ( IA , ISW )
2    SWRCE ( IA ) = SWRCE ( IA ) + SWRC ( IA , IE )
C
C**** SUM DAILY SEEPAGES OVER INDICATED PERIOD
C

```

```

DO 3 I = 1 , 9
3   SPS ( I ) = SPS ( I ) + SP ( I )
C
C**** SUM DAILY DEMANDS OVER INDICATED PERIOD
C
DO 4 IAR = LO , ICA3
4   DMNDS ( IAR ) = DMNDS ( IAR ) + DMND ( IAR )
C
C**** SUM DAILY DEMANDS MET OVER INDICATED PERIOD
C
DMDMT ( LO ) = SWRL ( LO ) + DMDMT ( LO )
DO 5 IAR = ICA1 , ICA3
KAR = IAR - 1
DMDMT ( IAR ) = SWRC ( KAR , IE ) + GWR ( IAR ) + DMDMT ( IAR )
IF ( DMDMT ( IAR ) .GT. DMNDS ( IAR ) ) DMDMT ( IAR ) = DMNDS ( IAR )
5   CONTINUE
C
C**** PRINT DATA ON INDICATED IDAY
C
IF ( IDAY .EQ. 7 .OR. IDAY .EQ. 14 .OR. IDAY .EQ. 21 .OR. IDAY .EQ. NDAY )
+GO TO 6
RETURN
6   CONTINUE
C
C**** PRINT STAGE AND STORAGE DATA
C
IYR = IYEAR+82
AVAIL=0
DO 80 I=LO,ICA3
AVAIL=AVAIL+(STO(I)-STOMIN(I))
80  CONTINUE
WRITE ( 5 , 200 ) MON, IDAY, IYR, ( STG( I ) , STO( I ) , I = LO, ICA3B )
+ , AVAIL
WRITE ( 7 , 200 ) MON, IDAY, IYR, ( STG( I ) , STO( I ) , I = ISA1, ISA3 )
200 FORMAT ( 3(I2.1X), 6(F6.2 , F9.0) , F11.0 )
C
C**** PRINT CALCULATED DISCHARGES
C
WRITE ( 3 , 210 ) MON , IDAY , IYR, ( SWRLS ( I ) , I = 1 , 6 )
WRITE ( 9 , 210 ) MON , IDAY , IYR, ( SWRC(I),SWRCS(I),I=1,3)
210 FORMAT ( 3(I2.1X) , 9 F 10.0 )
C
C**** PRINT CALCULATED SEEPAGE
C
WRITE ( 10 , 210 ) MON , IDAY , IYR, ( SPS ( I ) , I = 1 , 9 )
C
C**** PRINT CALCULATED DEMAND MET VERSUS DEMAND
C
WRITE ( 11 , 210 ) MON, IDAY, IYR, ( DMNDS(I), DMDMT(I), I=1,4 )
C
C**** REINITIALIZE SUMMATION VARIABLES TO ZERO
C
DO 10 I = 1 , 6
10  SWRLS ( I ) = 0.0
DO 20 I = 1 , 3
20  SWRC ( I ) = 0.0
DO 30 I = 1 , 9
30  SPS ( I ) = 0.0
DO 40 I = 1 , 4
40  DMDMT ( I ) = 0.0
DMNDS ( I ) = 0.0
RETURN
END

```

```

SUBROUTINE CTOSTG
C
COMMON      SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
+ QMXL ( 6 ) , STO ( 9 ) , RGSTO ( 4 ) , RGSTG ( 4 ) ,
+ STOMIN ( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , XAREA ( 7 , 10 ) , XAS ( 7 , 10 )
C
C**** CALCULATE STAGE FROM THE STAGE-STORAGE BREAKPOINT CURVE
C
DO 19 I = LO , ISA3
DO 17 J = 2 , MM ( I )
IF ( STO ( I ) - XSTO ( I , J ) ) 18 , 18
COMMON      SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
+ QMXL ( 6 ) , STO ( 9 ) , RGSTO ( 4 ) , RGSTG ( 4 ) ,
+ STOMIN ( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYFAR ,
+ IYEAR , MON , NDAY , ISTL
DO 19 I = IB , IL
DO 17 J = 2 , MM ( I )
IF ( DSTG ( I ) - XSTG ( I , J ) )
SUBROUTINE INSMX
C
COMMON      SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
+ QMXL ( 6 ) , STO ( 9 ) , RGSTO ( 4 ) , RGSTG ( 4 ) ,
+ STOMIN ( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , XAREA ( 7 , 10 ) , XAS ( 7 , 10 )
C
COMMON / QMAX / QLIM ( 3 , 10 ) , SLIM ( 3 , 10 )
C
DIMENSION RM ( 3 ) , B ( 3 )
C
DATA RM / 1 , 1 , .816 /
DATA B / -.5 , .5 , 1.336 /
C
C**** CALCULATE MAXIMUM DISCHARGE FROM LAKE OKEE ( ICA1 ) = 1200.
C
C**** CALCULATE MAXIMUM DISCHARGE FROM LAKE OKEEC. TO WCA2
C
QMXL ( ICA2 ) = ( 346. * ( STG ( LO ) ) - 2985. ) * 1.9835
IF ( STG ( LO ) .GT. 12.09 ) QMXL ( ICA2 ) = 2400.
C
C**** CALCULATE MAXIMUM DISCHARGE FROM LAKE OKEEC. TO WCA3
C
QMXL ( ICA3 ) = ( 410.9 * ( STG ( LO ) ) - 3500. ) * 1.9835
IF ( STG ( LO ) .GT. 13.38 ) QMXL ( ICA3 ) = 4000.
C
C**** CALCULATE THE MAXIMUM RELEASES FROM WCA1 , WCA2 , WCA3 TO WCA2 ,
C WCA3 , AND ENP RESPECTIVELY FROM THE STAGE-DISCHARGE BREAKPOINT CURVES
C
DO 50 IAR = ICA1 , ICA3
IA = IAR - 1
C

```

C**** ESTIMATE STAGE AT DISCHARGE STRUCTURE FROM AVERAGE STAGE IN WCA

```

C
  STSTG = RM ( IA ) * STG ( IAR ) + B ( IA )
  DO 40 LL = 2 , N ( IA )
    IF ( STSTG - SLIM ( IA , LL ) ) 20 , 25 , 40
20  QMXC ( IA , ISW ) = QLIM(IA ,LL-1)+(QLIM(IA ,LL)-QLIM( IA ,LL-1))*
    + (STSTG -SLIM(IA , LL-1))/(SLIM(IA ,LL)-SLIM(IA , LL-1))
    GO TO 45
25  QMXC ( IA , ISW ) = QLIM( IA ,LL)
40  CONTINUE
45  CONTINUE
50  CONTINUE

```

C
C**** CALCULATE MAXIMUM FLOWS FROM WCAS EASTWARD

```

C
  KCA1 = ICA1 - 1
  KCA2 = ICA2 - 1
  KCA3 = ICA3 - 1
  QMXC ( KCA1 , IE ) = 1800.
  QMXC ( KCA2 , IE ) = 191.8 * STG ( KCA2 ) - 1285.
  IF ( QMXC ( KCA2 , IE ) .GT. 1200. ) QMXC ( KCA2 , IE ) = 1200.
  IF ( QMXC ( KCA2 , IE ) .LT. 0. ) QMXC ( KCA2 , IE ) = 0.
  QMXC ( KCA3 , IE ) = 1300.
  RETURN
END
SUBROUTINE REGLO

```

```

C
  COMMON      SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
+ QMXL ( 6 ) , STO ( 9 ) , RGSTO ( 4 ) , RGSTG ( 4 ) ,
+ STOMIN ( 1 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) ,
  DO 100 IAR = ICA1 , ICA3
    IF ( STO ( LO ) .LE. RGSTO ( LO ) ) RETURN
    OVER = STO ( LO ) -RGSTO ( LO )
    UNDER = RGSTO ( IAR ) - STO ( IAR )
    IF ( IAR .EQ. ICA3 ) UNDER = UNDER + QMXC ( IA , ISW )
    SWRL ( IAR ) = AMIN1 ( QMXL ( IAR ) , OVER , UNDER )
    IF ( SWRL ( IAR ) .LT. 0 ) SWRL ( IAR ) = 0
    STO ( LO ) = STO ( LO ) - SWRL ( IAR )
    STO ( IAR ) = STO ( IAR ) + )
    SWRL ( ICAR ) =AMIN1 ( QMXL ( ICAR ) , OVER )
    STO ( LO ) =STO ( LO ) -SWRL ( ICAR )

```

C
C**** DETERMINE REGULATORY RELEASES THROUGH ST. LUCIE CANAL

```

C
  IF ( STO ( LO ) .LE. RGSTO ( LO ) ) RETURN
  OVER = STO ( LO ) -RGSTO ( LO )
  SWRL ( ISTL ) = AMIN1 ( OVER , QMXL ( ISTL ) )
  STO ( LO ) = STO ( LO ) - SWRL ( ISTL )
  RETURN
END
  ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , XAREA ( 7 , 10 ) , XAS ( 7 , 10 )

```

```

C
  DO 100 IAR = ICA1 , ICA3
  IA = IAR - 1

```

```

      IPA = IAR + 5
      OVER = STO ( IAR ) - RGSTO ( IAR )
1 ( QMXC(IA,ISW) , OVER )
C
C**** DETERMINE REGULATION RELEASES FROM WCAS TO THE EAST
C
C      SWRC ( IA , IE ) = AMIN1 ( QMXC(IA,IE) , OVER - SWRC ( IA , ISW))
C      IF ( SWRC ( IA , IE ) .LT. 0. ) SWRC ( IA , IE ) = 0.
C      STO ( IPA ) = STO ( IPA ) + SWRC ( IA , IE )
C      STO ( IAR ) = STO ( IAR ) - SWRC ( IA , ISW ) - SWRC ( IA , IE )
C      IF ( IAR .NE. ICA3 )STO( IAR + 1 ) = STO( IAR + 1 ) + SWRC(IA,ISW)
100 CONTINUE
C
C**** MAKE SURE MINIMUM REQUIREMENT OF EVERGLADES NATIONAL PARK IS MET
C
      KCA3 = ICA3 - 1
      IF( PKMET .GT. PKDM .OR. PKDM/NDAY .LT. SWRC(KCA3,ISW) ) GO TO 2
      PARKMIN = AMIN1 ( PKDM-PKMET , PKDM/NDAY-SWRC(KCA3,ISW) )
      STO ( ICA3 ) = STO ( ICA3 ) - PARKMIN
      SWRC ( KCA3 , ISW ) = SWRC ( KCA3 , ISW ) + PARKMIN
      IF ( STO ( ICA3 ) .GT. 18800. ) GO TO 2
      SWRL ( ICA3 ) = SWRL ( ICA3 ) - STO ( ICA3 ) + 18800.
      STO ( LO ) = STO ( LO ) + STO ( ICA3 ) - 18800.
      STO ( ICA3 ) = 18800.
2 CONTINUE
      RETURN
      END
      SUBROUTINE DELIV
C
      DIMENSION WAAV ( 6 ) ,RMUCK(12),EIRR(31)
C
      COMMON      SWRC ( 3 , 2 ) , QMXC ( 3 , 2 ) , SWRL ( 6 ) ,
+ QMXL ( 6 ) , STO ( 9 ) , RGSTO( 4 ) , RGSTG( 4 ) ,
+ STOMIN(4) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , XAREA ( 7 , 10 ) , XAS ( 7 , 10 )
      COMMON / CDMD / DMND ( 4 )
C
C**** READ DAILY SERVICE AREA DEMAND VALUEAVAILABLE FOR MEETING DEMANOS
C
      DO 1 IAR = LO , ICA3
      WAAV ( IAR ) = STO ( IAR ) - STOMIN ( IAR )
      IF ( WAAV ( IAR ) .LT. 0 ) WAAV ( IAR ) = 0.0
1 CONTINUE
C
C**** CALCULATE DELIVERY FROM LAKE OKEECHOBEE TO LAKE'S SERVICE AREA
C
      SWRL ( LO ) = AMIN1 ( DMND ( LO ) , WAAV ( LO ) )
      STO ( LO ) = STO ( LO ) - SWRL ( LO )
      DO 100 IAR = ICA3 , ICA1 , -1
C
C**** CALCULATE WATER TAKEN FROM GROUNDWATER AND SERVICE AREA STORAGE
C
      ISA = IAR + 5
      IA = IAR - 1
      GWR ( IAR ) = 0.0
      IF ( STO ( ISA ) .GT. 0. ) GO TO 3
      SWRC ( IA , IE ) = - STO ( ISA )
      STO ( ISA ) = 0.

```



```

3  GWR ( IAR ) = AM ( IE ) . LT . 0.0 ) SWRC ( IA , IE ) = 0.0
   STO ( LO ) = STO ( LO ) - SWRL ( IAR )
   STO ( IAR ) = STO ( IAR ) - SWRC ( IA , IE ) + SWRL ( IAR )
100 CONTINUE
   RETURN
END
FUNCTION STEP ( IF , IT , K )
C
C**** CALCULATE SEEPAGE AS A FUNCTION HEAD POTENTIAL. LENGTH 0 4 ) , RGSTG( 4 ) ,
+ STOMIN( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , YAREA ( 7 , 10 ) , XAS ( 7 , 10 )
DATA LEN / 20.2, 4., 10., 13.9, 24.5, 4., 5.9, 7.9, 25./
DATA CFSD / 6.9, 3.96, 3.96, 9.9, 11., 3.96, 11., 11., 33./
SEEP = ( STG ( IF ) - STG ( IT ) ) * LEN ( K ) * CFSD ( K )
+ QMXC ( 3 , 2 ) , SWRL ( 5 ) ,
+ QMXL ( 5 ) , STO ( 9 ) , RGSTO( 4 ) , RGSTG( 4 ) ,
+ STOMIN( 4 ) , XSTO ( 9 , 31 ) , XSTG ( 9 , 31 ) , N ( 3 ) ,
+ IDAY , PKMET , SP ( 12 ) , GWR ( 4 ) ,
+ ISW , IE , LO , ICA1 ,
+ ICA2 , ICA3 , ICA2B , ICA3B ,
+ ISA1 , ISA2 , ISA3 , NYEAR ,
+ IYEAR , MON , NDAY , ISTL ,
+ ICAR , MM ( 9 ) , STG ( 9 ) , PKDM ,
+ MA ( 7 ) , YAREA ( 7 , 10 ) , XAS ( 7 , 10 )
C
COMMON / QMAX / QMAX ( 3 , 10 ) , SLIM ( 3 , 10 )
C
C**** OPEN INPUT DATA FILES
C
OPEN ( 5 , FILE = 'DDATA' , STATUS = 'OLD' )
OPEN ( 1 , FILE = 'DDEL' , STATUS = 'OLD' )
OPEN ( 2 , FILE = 'DDMND' , STATUS = 'OLD' )
OPEN ( 3 , FILE = 'DRET' , STATUS = 00) INTYEAR , LYEAR
200 FORMAT ( 2I5 )
C
C**** CALCULATE NUMBER OF YEARS MODEL WILL RUN
C
NYEAR = LYEAR - INTYEAR + 1
C
C**** INITIALIZE CONSTANTS
C
READ ( 5 , 210 ) LO,ICA1,ICA2,ICA3,ICA2B,ICA3B,ISA1,ISA2,ISA3
+ , ISTL , ICAR , ISW , IE , QMXL ( ISTFORMAT ( 9 F 6.2 ) )
C
C**** READ LAKE AND WCAS STORAGE VOLUMES NOT AVAILABLE FOR MEETING DEMANDS
C
READ ( 5 , 221 ) ( STOMIN ( I ) , I = LO , ICA3 )
221 FORMAT ( 4F10.0 )
C
C**** READ STAGE-STORAGE RELATION FOR LAKE OKEECHOBEE, WCAS ,AND SERVICE AREAS
C
DO 10 I = LO , ISA3
READ( 5 , 1 ) MM ( I )
1 FORMAT ( I5 )
READ ( 5 , 2 ) ( XSTO ( I , J ) , XSTG ( I , J ) , J=1 , MM ( I ) )
2 FORMAT(2F10.0)
10 CONTINUE
C

```

```

C**** READ STAGE-AREA RELATION FOR LAKE OKEECHOBEE, WCAS ,AND SERVICE AREAS
C
      DO 71 I=LO,ICA3B
        READ( 5, 1 ) MA(I)
        READ ( 5 , 2)(XAREA(I,J),XAS(I,J),J=1,MA(I))
      /1  CONTINUE
C
C
C**** READ IN STAGE-DISCHARGE CURVE FOR WCA1 ,WCA2 , WCA3 AT S-10,S-11, S-12
C
      DO 30 IA = ICA1 , ICA3
        I = IA - 1
        READ ( 5 , 1 ) N ( I )
      30  READ ( 5 , 2 ) ( QDIM ( I , J ) , SLIM ( I , J ) , J=1 , N ( I ) )
C
C**** CONVERT STAGE TO STORAGE FO EACH AREA
C
      CALL CTOSTO ( IO , ISA3 , STG , STO )
      CLOSE ( 5 )
      RETURN
      END

```